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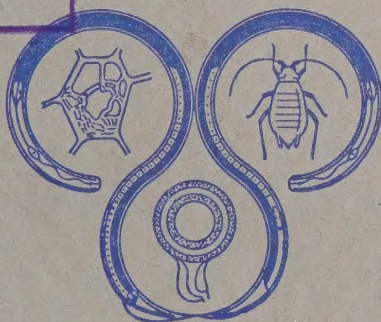
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Onder redactie van

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SECOND SYMPOSIUM ON VIRUS DISEASES OF FRUIT TREES IN EUROPE

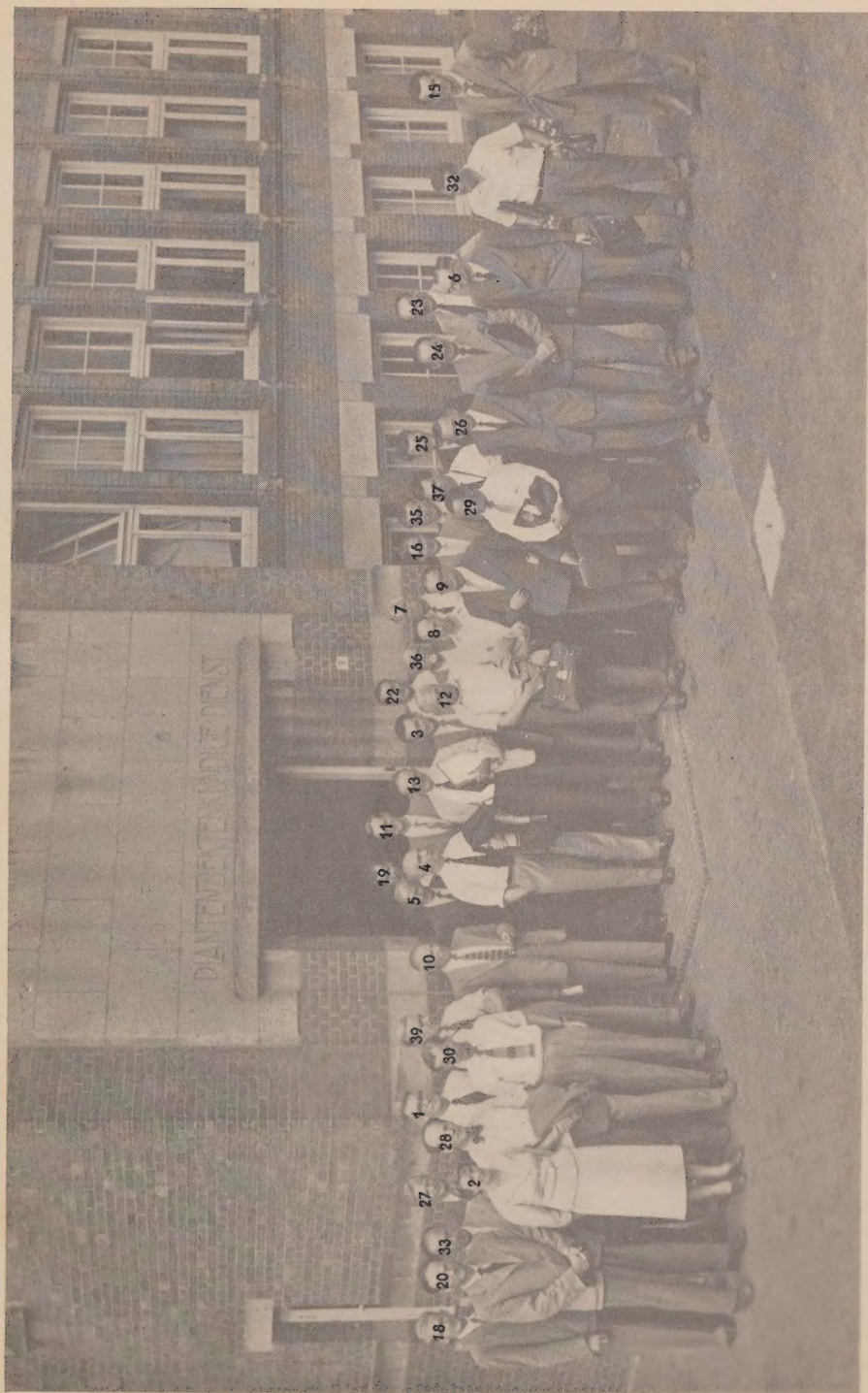
August 23-27, 1955
Wageningen, Netherlands

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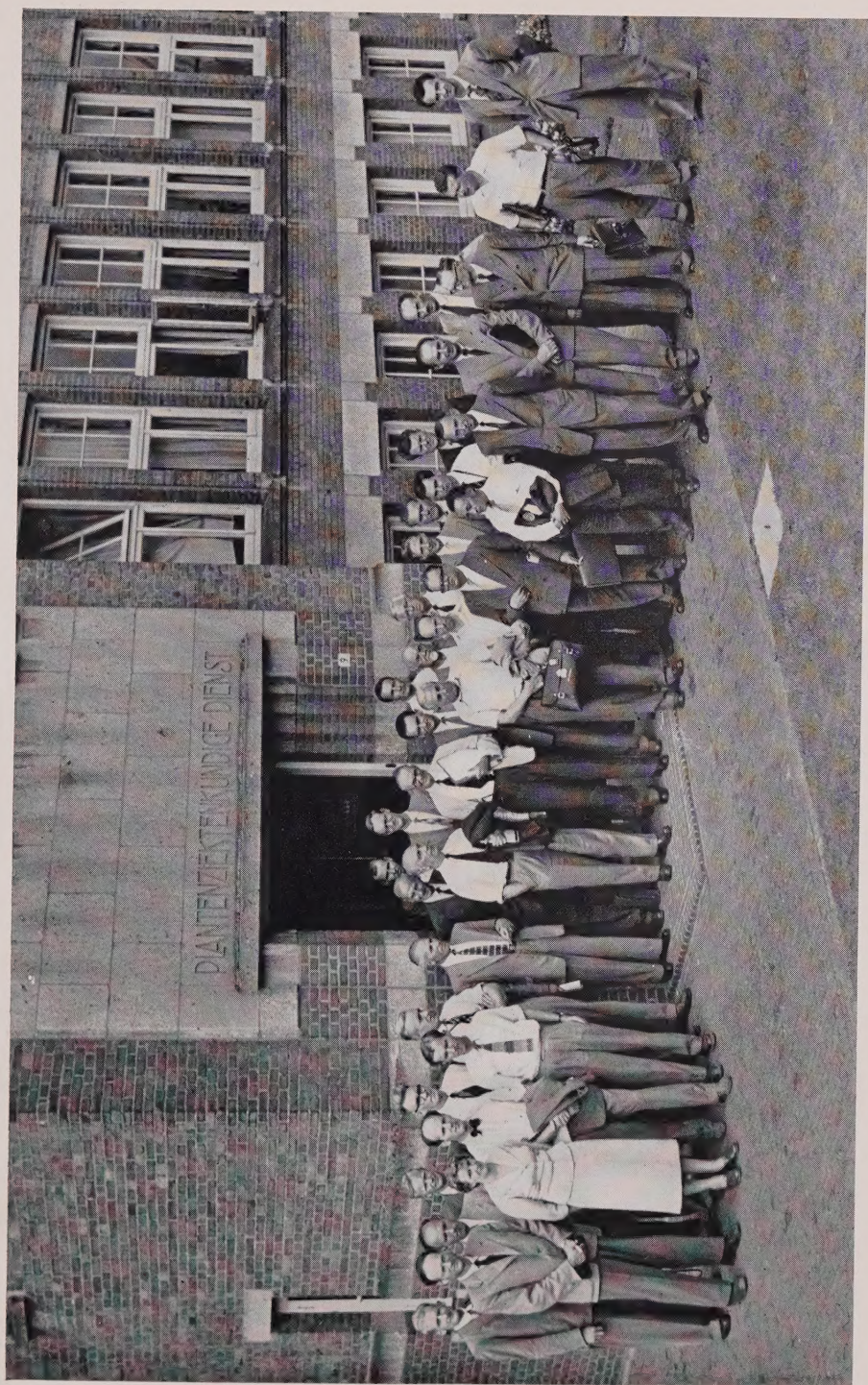
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INTRODUCTORY NOTE

In 1954 Dr S. BLUMER took the initiative to gather in Switzerland a number of European workers in the field of virus diseases of fruit trees at the occasion of the visit of some wellknown virologists from U.S.A. and Canada. By organizing this symposium his intention was to contribute towards a closer contact between the research workers in this field and towards international cooperation. Certainly Dr BLUMER succeeded in his intentions.

At that symposium the proposal was made to maintain these contacts and to have such symposia more regularly. It was decided then that the next symposium should take place in the Netherlands in 1955. As there was also in the Netherlands in that year the 14th International Horticultural Congress it was thought practical to have the symposium shortly before the Congress so as to have the chance of welcoming fruit virologists from other continents.

This second Symposium on Virus Diseases of Fruit Trees in Europe was organized by the Institute for Phytopathological Research and the Plant Protection Service, both in Wageningen, Netherlands.

The papers read at the symposium and the conclusions reached after a discussion on international cooperation in fruit tree virus research are included in this publication. The organizing committee hopes that it will fulfil a need to more concrete documentation and that it may contribute also a little towards the international cooperation in this field.

We gratefully acknowledge the financial aid of the Ministry of Agriculture, Fisheries and Foodsupply of the Netherlands, the Institute for Phytopathological Research, the Plant Protection Service and the Editorial Board of the "Tijdschrift over Plantenziekten" which made this publication possible.

Extra copies of this issue are available at the address of this journal; price f 3.50.

The organizing committee,

D. MULDER

C. A. R. MEIJNEKE

OPENING ADDRESS

BY

J. G. TEN HOUTEN

Director of the Institute for Phytopathological Research, Wageningen, Netherlands

Ladies and Gentlemen,

It is a great honour to me to welcome you at the second Symposium on Virus diseases of Fruit Trees in Europe. We highly appreciate that so many distinguished workers in this field accepted our invitation.

There are participants not only from 10 European countries, but Canada, U.S.A., New Zealand and Equador are also represented. It is of course impossible to welcome every guest individually, but you will allow me to make a few exceptions. In the first place we are very glad to have with us Dr. BLUMER from Switzerland, who took the initiative for the first conference on fruit tree virus diseases in Europe, which took place last year.

A special welcome is also due to Dr. BERKELEY from Canada. As many of you will know Dr BERKELEY was one of the three compilers of the Handbook of virus diseases of stone fruits in North America. This book was published as early as 1942 by the Michigan Agricultural Experiment Station. Dr BERKELEY was also a member of the publication committee which revised and extended this book to the wellknown and excellent Agriculture Handbook nr. 10, issued by the United States Department of Agriculture in 1951. Therefore Dr BERKELEY seems certainly in a position to act as a liaison officer between the American and European scientists in this field.

It seems rather astonishing that until recently Europe as a whole has paid but little attention to virus diseases of fruit trees, whereas American plant pathologists have been concerned with these diseases for more than 25 years. This is partly due to the fact that at that time these diseases were less important in Europa. It may also be that one did not realize the economic losses due to fruit tree viruses. The same happened with potato latent mosaic (or virus X) in U.S.A., where until recently it was present in practically every potato plant grown. It was not before 1945 that its damage was measured. Then it was found that it gave an average loss of 13 % of the crop. According to Dr CHESTER this average loss is four times the annual average loss from potato late blight! This undoubtedly is a serious warning not to underestimate the losses caused by fruit tree viruses even if they seem rather harmless in many cases.

I got an unexpected confirmation of this statement in a letter from Dr VAN DER WANT, one of our virologists working on a fellowship in U.S.A.. Dr. MILBRATH from Corvallis explained to him that many young cherry trees in Oregon nurseries are infected with latent viruses. By distributing virus free material of some cherry varieties it was found that these so-called latent viruses caused a severe growth retardation. This is clearly demonstrated by the fact that nursery trees with latent viruses could only be delivered after five years whereas young virus free trees grew so rapidly that two years were sufficient for delivery. Growers even complained that these virus free trees grew too fast!

As Dr VAN DER WANT points out in his letter one can well imagine that those virus free trees will also produce fruits earlier and more abundantly than infected trees even if the latter do not show any symptoms of disease.

Although disastrous outbreaks such as the charka disease of plums in Yugoslavia and the Pfeffinger disease of cherries in Switzerland are still exceptional, it is clear that many virus diseases of fruit trees do occur in Europe and that they form a menace to our fruit orchards.

As with all crops propagated vegetatively there is always the often hidden danger of rootstocks or grafts becoming virus infected without this being recognized in the beginning. This danger was put forward very clearly by Dr HARRIS in his lecture on 'The maintenance of healthy fruit clones', which he held at the Thirteenth International Horticultural Congress in 1952. Dr HARRIS formulated this point as follows: 'The majority of fruit virus diseases so far identified are more or less slow decline-diseases, infection with which unfortunately does not therefore cause the rapid elimination of the diseased host plant but, failing early removal by human agency, initiates a long career of evil-doing as a potential source of infection and of infected vegetative progeny...

In the case of the long-lived tree-fruits roguing in established orchards is, on our present knowledge, a serious undertaking of problematic efficacy. In all affected crops, however, the primary theatre for virus disease roguing is in the source of nursery material.'

With strawberries and raspberries much progress has been made. Here the use of indicator plants and vectors enables us to select entirely healthy clones which can be used as foundation stock. With fruit tree viruses, however, the problem seems more complicated. In the first place we lack reliable and quick testing methods. Still such methods are essential in order to be sure that both rootstock and scion are practically virus free. Secondly our knowledge of indicator plants and vectors is still very limited.

Compared with the situation in U.S.A. and Canada, where many scientists study virus diseases of fruit trees, particularly of stone fruits, we in Europe are generally speaking rather in the beginning. We should therefore intensify our efforts a.o. by appointing more research workers in this field. This certainly holds for the Netherlands, where we are still in the diagnostic stage. In England research has already advanced further and some virus free clones have been produced.

Much work has to be done in order to find possible vectors of the diseases. Also the identification of fruit tree viruses is difficult, for one thing because we cannot introduce virus diseased material from other countries. Moreover the symptoms may vary as a result of different climatic conditions. Should one succeed in finding more suitable herbaceous indicator plants rapidly developing characteristic symptoms this could at least solve part of the difficulties of identification.

Symposia like the present one are of the greatest importance. Here only a rather small group of specialists discuss their problems. Contrary to the often very crowded international congresses this offers the opportunity for easy and if necessary extensive discussions between research workers speaking the same scientific language. I foresee that our ever increasing specialism will finally bring us to a stage where big international congresses will be of no use anymore. Then only small group conferences like this one will be accepted.

The last day of this symposium will be confined to international cooperation in fruit tree virus research. This is I think a very good idea. In order to have the full profit of this research work this cooperation should be widened into a world wide contact of research workers including those in Canada, New Zealand, U.S.A., U.S.S.R. and other countries.

Herewith I declare this second symposium on virus diseases of fruit trees open and wish you all a most successful and pleasant conference to be followed by further discussions in the near future.

T. Plizickten 62 (1956): 39-42

UNUSUAL FEATURES OF SOME NEW ZEALAND FRUIT TREE VIRUSES

BY

J. D. ATKINSON

Director, Fruit Research, Plant Disease Division of the Department of Sci.
and Industrial Research, New Zealand

It is only during the past nine years that we have recognised virus diseases in the fruit trees of New Zealand. No great progress has been made but I would like to mention some features of our fruit tree viruses that may be of interest. It would be of considerable assistance if you could bring up in discussion unusual features of similar diseases that you have encountered.

GREEN CRINKLE OF APPLES

This was not recognised as a separate disease until 1934 when an investigation was made into the much more serious problem of internal cork. During a survey of orchards in the Nelson area, several growers pointed out trees of Dunn's or Granny Smith that consistently produced distorted apples bearing a superficial resemblance to those affected by internal cork. When apples were cut open it was at once obvious that the disorders were not identical as there was no internal pitting in fruit infected with green crinkle. In the following season, when it was found that borax eliminated symptoms of internal cork but not those of green crinkle, the difference was confirmed.

An unusual feature of green crinkle is that the symptoms may remain confined to one branch of a tree for at least ten years. During that period one infected branch consistently produced distorted apples but no symptoms were observed in other parts of the tree. It is not known whether the virus is present though masked in other parts of the tree. This localisation of symptoms has also been noted in stony pit of pears. In one tree observed for four years, severe symptoms appeared regularly on one main branch while the rest of the tree produced apparently normal fruit. Scions taken from this infected branch caused systemic infection in healthy trees to which they were grafted. Lack of material has prevented the testing of other parts of the tree for the presence of the stony pit virus in masked form.

Another feature of green crinkle that is a little unusual for a plant virus is

that symptoms have been found only on fruit. A careful search for other expressions of the virus has given negative results. This appears to be a point of difference between green crinkle and rough skin. Of the other proven fruit tree viruses occurring in New Zealand, apple ring spot and plum pox are the only ones that appear to exhibit fruit symptoms only. Two suspected peach viruses, peach crinkle and stark blemish also fall into this category.

Green crinkle causes two quite distinct symptoms on fruit. Usually, infected apples are stunted with characteristic creases and folds distorting the surface, but occasionally they develop wart like swellings covered with rough russet. In the latter case there is little if any stunting. The two symptoms seen on different apples appear quite distinct, but they may both develop on a single fruit, or a tree may produce fruit with folds one year and lumps the next.

We have found no evidence of natural spread of green crinkle in the field, although natural root grafting is known to occur with the Northern Spy stock commonly used throughout the country. Thus it appears that no insect vector is present in our orchards. The variety Granny Smith which is most commonly affected came into favour quickly during the 1930's, many trees of older varieties being reworked during that decade. Much of the infection present in blocks of Granny Smith can be traced to the use of infected scions at a time when the cause of this disease was unknown.

RING SPOT OF APPLES

Like green crinkle, ring spot appears to produce only fruit symptoms on apple, but this and the ability to cause two distinct types of symptom are the only features common to the two diseases. The most usual expression of ring spot consists of a number of irregular patches of varying shades of brown with a rough russeted surface, and a scaly margin. In this form ring spot symptoms closely resemble bronze beetle injury and some types of spray russet. Shortly before harvest a narrow band of smooth dark brown tissue forms round the margin of many spots, and this we regard as a reliable diagnostic feature. After picking, this outer brown strip occasionally continues to develop, but most spots remain unchanged throughout the storage life of affected apples.

A less common but more striking symptom of ring spot is a series of concentric rings of dark brown tissue. Occasionally rings are almost complete, but fragmentary rings are more common. A few apples have been found showing sets of concentric rings with no patches of russet, but usually any rings found are mixed with russet symptoms. We first called this disease thumb mark, as the ring symptoms resemble thumb prints, but when surveys showed this to be a rare symptom the name was dropped.

On trees that show marked symptoms, ring spot reappears year after year, but the percentage of fruit affected and the severity of symptoms varies widely from season to season. We have not been able to find any explanation for this variation. On some trees showing a small percentage of affected apples in one year, it is often impossible to find any symptoms in the following season.

It is curious that ring spot should be widely distributed in an apple variety reputed to be an Australian seedling, but not yet reported from Australia or Tasmania. New Zealand has a most varied native flora, but few native roseaceous plants. We have found only one case of a native plant infected with a

virus, this being a disease called yellow leaf in the monocotyledon *Phormium tenax*. Thus the chances that any of our fruit viruses have come from the native flora seem remote. Most of our apple varieties were imported as worked trees or scion wood and the general picture of fruit viruses is very similar to that found in Europe and North America. We are puzzled that ring spot has not yet been reported from other countries. A recent letter from the U.S.A. suggests that a similar disease has been found there.

We know that ring spot has been present in Granny Smith since 1935, but until a few days before I left New Zealand there was no good evidence of its presence in any other variety. We have now found one Sturmer tree on one of our experimental orchards showing an appreciable percentage of apples with symptoms closely resembling the russet form of ring spot. Odd fruits of Cox's Orange, Delicious and Sturmer showing patches of russet edged with a smooth brown strip have been found in other seasons at widely different parts of the country, but these symptoms have not been found again in later years.

Our evidence of ring spot transmission by grafting from Granny Smith to other trees of the same variety is still slight, and we have not yet been able to transmit this disease to any other variety. Ring spot infected grafts were worked into healthy Granny Smith trees in 1949. Scions were placed at the tops of main branches and near the base of laterals. There was no suggestion of incompatibility and symptoms appeared in the first fruit carried by these scions and have reappeared in every subsequent crop on this infected wood. Less than 0.1% of the total crop from the originally healthy trees has shown typical symptoms. However, for the past two years one small lateral near one of the original grafts, has produced typical ring spot symptoms on each of the five or six apples that it produced. The evidence from this single lateral is clear cut when you see it in the field and it suggests that we are dealing with a virus that is transmitted much more slowly than most other fruit viruses. We have not yet found any evidence of natural spread in the field.

This brief outline covers the more unusual features of green crinkle and ring spot. In conclusion I would like to raise two other disconnected points as they may be of general interest.

First, the form of incompatibility caused by plum mosaic in a few plum and apricot varieties. As this will be dealt with more fully during the Congress proper I will give only a base outline now. Budding trials have shown that the Japanese type plums, Burbank, Sultan and Wilson's Early cannot be budded onto cherry plum stocks infected with one strain of plum mosaic, and that infected cherry plum buds would not grow on healthy trees of these three varieties. With the plum variety, Duff's Early Jewel and the apricots Moorpark and Roxburgh Red there was marked incompatibility but a small percentage of buds grew on infected stocks.

We have since found one tree of Burbank and one of Wilson's Early showing natural infection. With fourteen other varieties of Japanese plum there was no evidence of plum mosaic causing incompatibility.

Second, we have observed recently a case of apple mosaic spreading naturally to healthy apple seedlings in the nursery row. There have been reports from England of natural spread although so far as I know no vector has yet been identified. With us apple mosaic is so widespread and mild symptoms so hard to detect that we have not attempted any counts in established orchards. The

existence of natural spread may well prove an embarrassment in experimental work, and will certainly increase the difficulties of control.

DISCUSSION

RØNDE KRISTENSEN: showed some deformed apples of the Danish variety Güldborg and asked whether these deformations are similar to those of green crinkle. They have been transmitted by grafting in Denmark.

Answer: The symptoms are quite similar to those of green crinkle on other varieties and so they may be caused by this virus.

POSNETTE: Does there exist, after the opinion of Dr ATKINSON, a possibility of seed transmission of the apple mosaic virus? It sometimes occurs that apple seedlings develop mosaic symptoms and seed transmission seems more likely than spread of the disease in the nursery.

Answer: There is not previously known any case of seed transmission of the apple mosaic. But in New Zealand the Jonathan variety contains for 100% a mild form of apple mosaic. Furthermore the English 'variegation' in the seedlings is quite similar to apple mosaic. So seed transmission might be a possibility.

T. Pl.ziekten 62 (1956): 42-46

FLAT LIMB (FUREDE GRENE) OF APPLE TREES

BY

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DISTRIBUTION IN VARIOUS COUNTRIES

Flat limb was mentioned in an Australian report (JAS. LANG) as early as 1905 but was then considered a purely genetical phenomenon. In 1907 the disease was reported from Connecticut (G. P. CLINTON) in U.S.A. and then supposed to be frost damage. Later on - in 1911-12 - another hypothesis was brought forward by Australian workers (D. MC. ALPIN), namely that flat limb was due to incompatibility between the rootstock and the scions of certain apple varieties. In 1938 workers in British Columbia (J. W. EASTHAM) believed that flat limb most probably is a virus disease, as no fungus or bacterium had been found in connection with the disease. From Italy flat limb is reported in 1941 (A. BIRAGHI) as a graft transmissible disease, which has been known in Italy for many years. A Californian report from 1942 (H. E. THOMAS) describes the disease as a virosis, which is graft transmissible to *Pyracantha* sp. From Nova Scotia in 1943 (J. F. HOCKEY) flat limb was described as very annoying in the apple variety Gravenstein. In one fruit farm the disease could have existed for at least 40 years. Investigations carried out in Nova Scotia show, that flat limb is transmitted with scions from infected trees, and the results indicate that symptom expressions are strongest on trees growing on rather weak rootstocks (E.M. IX). In the Nova Scotia report it is concluded, that if flat limb

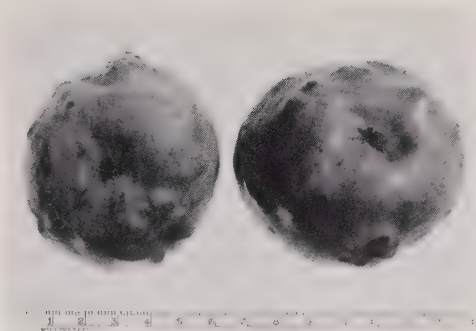


FIG. 1. Green crinkle on Sturmer apple; wart symptoms

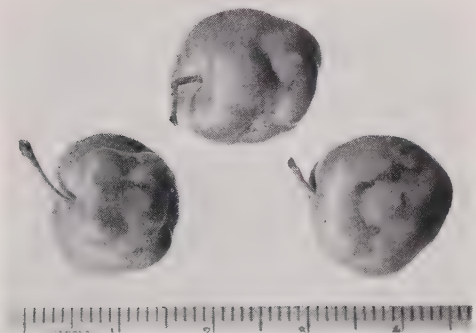


FIG. 2. Granny Smith apples showing severe symptoms of green crinkle

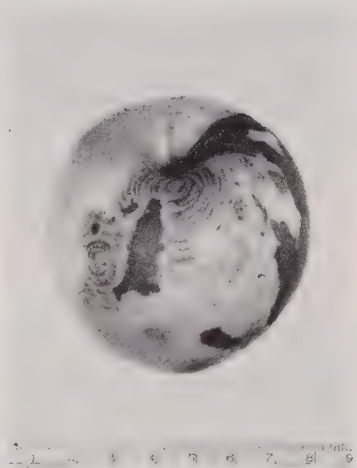


FIG. 3. Granny Smith apple with both concentric ring and russet symptoms of ring spot

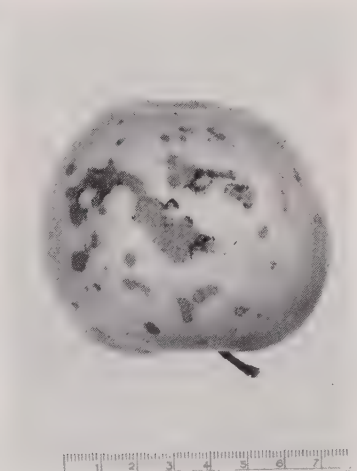
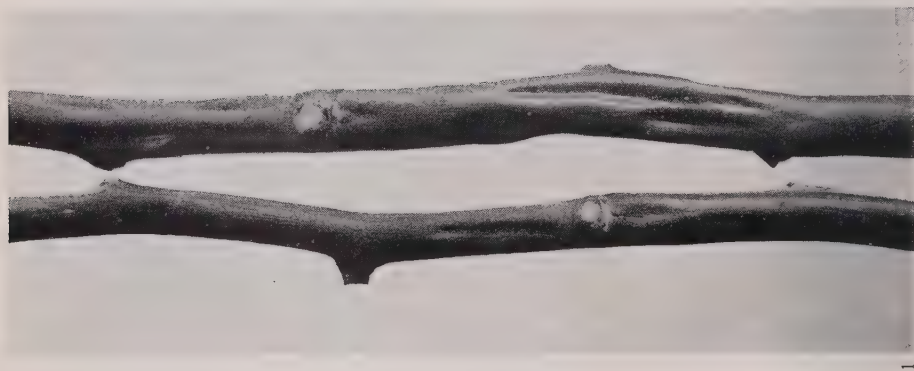
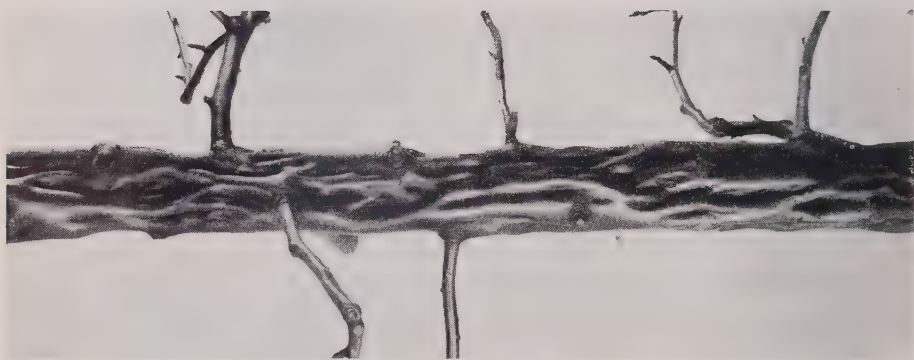


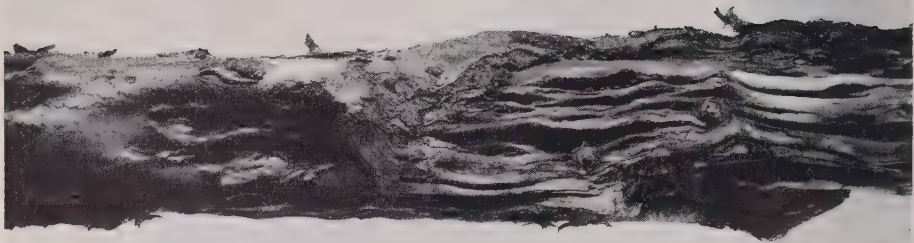
FIG. 4. Russet patches with brown margins beginning to form on a Granny Smith apple infected with ring spot



1



2



3

FIG. 1. Flat limb in Gravenstein. Symptoms in one-year old shoots. FIG. 2. Flat limb in Gravenstein. Severe symptoms in seven-year old branch. FIG. 3. Flat limb in Gravenstein. Very severe symptoms in old branch. Necrosis and exposing of wood

is caused by a virus, it must be a very selective one, which only produces symptoms under special conditions.

In all the earlier reports concerning flat limb, the disease has only been mentioned in the variety Gravenstein; but in 1944 it was reported from England (WALLACE, SWARBRICK and OGILVIE), that flat limb was also seen in Lord Lambourne. In recent years the disease has been described in many European countries as occurring in several apple varieties. In Holland (personal information from D. MULDER) the phenomenon has occurred in the variety Signe Tillisch and in Sweden (D. LIHNELL 1949) flat limb has been observed in both Gravenstein and Signe Tillisch. The same two varieties together with Filippa and James Grieve have been reported from Norway as infected (T. RAMSFJELL 1950) and in 1952 the disease is described in Gravenstein and Signe Tillisch growing in the fruit district in Nether Elb in Germany (H. BÖMEKE).

DISTRIBUTION IN DENMARK

In Denmark flat limb was first described in 1940 (E. GRAM and A. WEBER), but diseased material was already delivered to 'The Danish State Experimental and Research Station for Plant Diseases and Pests' in 1936. Danish fruit growers claim to have seen the disease some 40 years ago, but then no one took any notice of these cases. Flat limb seems, however, to be much more widespread today and also the attacks seem much more serious than in earlier years. The disease is now to be found in many fruit farms all over the country, mainly in Gravenstein but also in some other apple varieties (Signe Tillisch, Filippa, Ildrød Pigeon, Dronning Louise, Rød Høst-Kalvil, Høve Reinnet, James Grieve, Lord Lambourne, Lord Suffield, Guldborg and Rød Ananas).

Flat limb has been found in trees growing on various types of soils and also on many different rootstocks (E.M. IV, IX, XVI and apple seedlings).

In Denmark several theories concerning the cause of flat limb have been brought forward. At one time it was thought that the phenomenon might be due to excess of nitrogen and it has also been considered that lack of zinc or boron had something to do with the disease.

It is only some 10 years ago, that a virus was suspected to be the real cause, and the various investigations carried out since then, strongly support that view.

SYMPTOMS OF FLAT LIMB

The first external symptoms to be seen consist of a very weak flattening or slight linear depressions in the shoots or branches of infected trees. Later deep furrows occur, or the branches may be completely flattened out and very often much twisted. At the same time necrosis develops on the diseased branches, which become very weak and brittle. In several cases the symptoms are only to be seen in the older branches, but symptoms have also occurred in the very young shoots – in some cases even in the current years growth. The effect of the disease varies considerably. On some infected trees the damage – if any – is very slight and the symptoms are hardly visible. In other cases, infected trees are severely damaged and almost completely ruined.

Sometimes the symptoms can be seen while the trees are very young, and now and then even in the nurseries. But mostly infected trees first show signs

of the disease, when planted out in the fruit farm, and in some cases several years may pass before any symptoms occur.

These facts can explain, why several fruit growers often declare, that flat limb is spreading in the fruit farms. Most probably the elder trees, which show symptoms of the disease, have already been infected in the nursery. It is not yet known what conditions conduct the speed of and the whole development of the symptoms, but several factors may play a role. It is likely, that the virus in question occurs in several strains, some of which are weak, while other are very severe. The rootstock may also have some influence, and conditions which favour vigorous growth also seem to strengthen the symptoms of flat limb.

DANISH INVESTIGATIONS CONCERNING FLAT LIMB

Since 1948 various grafting experiments concerning flat limb have been carried out in Denmark.

These experiments can be divided into five groups:

- I. In the first group, scions from healthy Gravenstein-trees have been grafted into infected trees of the same variety.
Four years after the grafting 22 trees out of 27 showed symptoms of flat limb in the growth from the inserted scions, and in two of the trees, the symptoms occurred already in the current years growth – in the year of grafting (eight months after the grafting).
- II. In the second group, scions from diseased Gravenstein-trees were grafted into healthy trees of 12 different apple varieties.
Five years after the grafting 37 of 44 trees showed symptoms of flat limb in the growth from the inserted scions, but in no case could any symptoms be observed in any of the grafted trees, even though some of the varieties are susceptible to flat limb. Apparently no downward movement of the virus takes place.
- III. In the third group, scions from healthy trees of 10 different varieties were grafted into diseased Gravenstein-trees, but the disease – or to be correct the symptoms – were only transmitted to two varieties, namely Red Pigeon and the Danish variety Bodil Neergaard.
- IV. In the fourth group healthy scions of Gravenstein were topgrafted into symptomless branches of the Danish varieties Høve Reinnet and Ingrid Marie, which some years earlier had been grafted on diseased Gravenstein-trees.
The topgrafted Gravenstein showed symptoms of flat limb on a few trees of both varieties – in Ingrid Marie already one year after the topgrafting.
- V. In the fifth group some 30 E.M. IX rootstocks were budded with material from infected Gravenstein-trees. The following year symptoms were observed in 23 of the young trees.

CONCLUSIONS

The experiments clearly show, that flat limb is a graft-transmissible disease.

The experiments also demonstrate, that there is a great difference between the susceptibility of the various apple varieties, and furthermore that some varieties can act as symptomless carriers.

As it is rather difficult or impossible to remove all infected trees in the nurseries by inspection and roguing, steps have been taken to establish a nucleus stock of all important apple varieties, from which the nurseries can be supplied with grafting and budding material.

Important questions concerning flat limb, which are not yet solved, are a further search for symptomless carriers among the important apple varieties and also among the apple rootstocks.

Furthermore it would be of value to know the exact effect of the disease on growth and fruit production of the infected trees. Experiments concerning these problems are now in progress.

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DISCUSSION

SCARAMUZZI: Since the symptoms of psorosis in Citrus are very similar to those of flat limb in apples will it not be better to replace the name psorosis in Citrus by flat limb?

Answer: Similarity of symptoms in different plants is not a reason for giving the same name and this is even undesirable because of the probability of two viruses being involved.

THUNG: Is there an insect vector known?

Answer: Some years ago it has been tried to transmit the disease by aphids, but these trials had no result.

BLUMER: After Swiss experience flat limb diseased trees often give a very good yield. So the growers are sceptical about the damage caused by this virus. Are there details available about the Danish experience on this matter?

Answer: In some cases there are only very few symptoms and then the yield is good, but in other cases there is much reduction in the crop.

The deformation of the crowns of the trees is the most important result of

flat limb. The yield may be good but it is impossible to grow a well shaped tree. So the growers will eradicate such trees even if the yield may not be influenced so much (THIEM).

In New Zealand flat limb causes serious losses in the Gravenstein variety as branches showing severe symptoms stop growing and the fruits become small and rough (ATKINSON).

T. Pl.ziekten 62 (1956): 46-49

ROUGH SKIN OF APPLES¹⁾

BY

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In contrast to the situation in stone fruits of which already a large number of virus symptoms is known, in apples and pears only few virus diseases have been found. In Holland some of these virus diseases occur.

Symptoms of unknown cause on the fruits of apple trees of the varieties Belle de Boskoop and Glorie van Holland in scattered orchards were found in the Netherlands several years ago. These symptoms which are generally well defined concern a roughening of small or larger parts of the skin of the fruits and cause serious losses.

Rough corky brown patches develop on the skin of the fruits. Sometimes these patches are small and have a somewhat circular shape. In other cases rough brown rings or elongated stripes can be seen, whilst the fruits of heavily infected trees often show a roughening of large parts of the skin. It has been observed that in some cases the rough brown patches are cracked and the fruits may show a slight deformation due to local growth retardation. The patches develop both in the green and coloured parts of the skin.

The symptoms mentioned occur first on the fruits of one or some branches of an infected tree, but gradually they appear also on the fruits of other branches and finally they can be found over the entire crown. The number of affected fruits of a tree increases rather rapidly within a few years.

Fruitgrowers have observed that the number of infected trees in orchards also increases during a period of several years. For that purpose one fruitgrower kept apart the apples of each Boskoop tree in his orchard during picking time and sorted them out on rough skin symptoms. From these observations it has become likely that there is also a spread of the disease from tree to tree. However it is not yet known whether this spread takes place in a natural or artificial way.

This disease, which in the Netherlands is called 'ruwschilligheid', meaning 'rough skin', causes heavy losses. The growth of the fruits of infected trees is retarded and in consequence these fruits remain smaller. Affected fruits can be sorted only in the lowest commercial grades and have only little market value.

The rough skin symptoms can already be found soon after the first development of the fruits. In our country the disease is only found in older trees.

As was said before mainly the apple varieties Belle de Boskoop and Glorie

¹⁾ Photos of the symptoms have been published in Tijdschr. o. Plantenz. 61: 4-6 (1955).

van Holland develop rough skin symptoms in the Netherlands, but the disease was also found occasionally in some other varieties as Dijkmans Zoet, Golden Delicious and Notaris.

In order to investigate the rough skin problem an inquiry was set up in 1951 among fruitgrowers in various parts of the country. From this inquiry it became clear that the disease occurred in trees on all kinds of soil, on various rootstocks and under different food conditions. Only the bad water conditions of the soils showed correlation. A second possibility was that the symptoms might be of virus nature. Thus in 1952 experiments were set up in the experimental garden of the Plant Protection Service at Wageningen. Five out of ten healthy young Boskoop trees – red type – were grafted, each with four to five grafts of Boskoop trees – green type – showing rough skin symptoms. The other five trees remained ungrafted for comparison.

In 1954 fruits developed on the branches of both the indicators and the grafts. After examination in September some fruits just below the grafts on the branches of the indicators turned out to show rather clear rough skin symptoms. The other apples of the indicators were still symptomless. It should be stated here that the apples of the grafts showed the symptoms very clearly. On the non-grafted trees not a single apple with rough skin symptoms was found. Evidently the rough skin symptoms are grafttransmissible and must be caused by a virus.

One month afterwards, in October 1954, a fruitgrower who grafted some grafts from diseased trees on a healthy Boskoop tree, came to the same conclusion.

In other countries similar symptoms have been found. In Germany a disease called 'Stilettenkrankheit', is known. The symptoms agree with the rough skin type, which shows small cracks in the rough patches. In Switzerland rough skin symptoms in Boskoop-apples locally cause considerable losses in the quality of the fruit. FISHER reports on this matter.

According to personal information from BLUMER and BOVEY rough skin symptoms are found in southern Switzerland. They also detected rough skin apples on the market at Avignon, France. Furthermore similar symptoms occur in Denmark and in Sweden, where RAMSFJELL detected a slight cracking of the fruits, which he calls star-cracking.

MULDER, at Wageningen, observed trees of the variety Glorie van Holland with rough skin symptoms on the apples. He found a slight local clearing of small parts of the veins in only a few leaves near the tops of some shoots. Since he found similar leaf symptoms on the leaves of Boskoop trees grafted with rough skin diseased Glorie van Holland he suggests that they may be associated with the rough skin virus disease. However this supposition has not yet been proved definitely. As a matter of fact such vein clearing symptoms should facilitate the detection of infected trees in summer, when rough skin symptoms on the apples are not always very clear.

In general however one can see the first roughening already shortly after the first development of the fruits. Later in the season some patches may crack. These symptoms differ from those observed in New Zealand and Canada, called respectively green crinkle and false sting.

Both green crinkle and false sting are characterized by rather severe cracking of the fruits, whilst only later in the season some slight roughening in these

cracks may appear. We never found such severe deformation of the apples as shown for green crinkle by ATKINSON this morning. I therefore have the opinion that rough skin and green crinkle or false sting are not identical. Some symptoms of the ring spot virus disease mentioned from New Zealand resemble those of our rough skin. We did not yet find however those concentric rings.

Summarizing we can conclude that the rough skin virus disease of apples gives serious problems when growing certain apple varieties in the Netherlands as well as abroad. In the Netherlands the disease has not yet been found in young trees in modern orchards owing to careful selection of the mother trees, which are used for propagation by means of grafts.

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DISCUSSION

POSNETTE: In England there has been found a disease similar to rough skin. This disease is called 'star crack'. The variety Cox's Orange Pippin is the most commonly affected in England. Has this variety been found affected in the Netherlands too? In other varieties the symptoms may vary. Rough skin with only little star cracking has been found in the varieties James Grieve, Boskoop and Bramley's Seedling in England. Furthermore it has been observed that infected trees start flowering about three weeks later than healthy trees. Is this phenomena known from Holland too?

Answer: In the Netherlands only the varieties Belle de Boskoop and Glorie van Holland have been found severely affected. In Cox's this disease has never been found up to now. There are not yet any details available on the beginning of the flowering time of diseased trees in Holland.

SCARAMUZZI: What is the difference between the ringspot disease in New Zealand and the rough skin in the Netherlands?

Answer: Many of the symptoms of rough skin resemble very much those of ring spot, but we never found these concentric rings and also no serious deformations. In future these diseases probably may show to be caused by the same virus or by strains of the same virus. Further experiments with uniform indicators must be set up to detect whether there is a connection between these two diseases.

The deformation has only been found in a few cases (POSNETTE).

The deformation is typical for the green crinkle, not for the ringspot (ATKINSON).

ATKINSON: Is there any dieback associated with the rough skin in the Netherlands?

Answer: No, in the Netherlands dieback symptoms were never found in the affected varieties.

In England dieback has only been found in the Cox's variety showing star crack. Other varieties infected do not show dieback (POSNETTE).

CIFERRI: Symptoms of rough skin and of green crinkle have not been found in the same varieties. Is it known if green crinkle on unripe fruits probably evolves to rough skin in ripe ones?

Answer: This is not likely. Green crinkle shows early in the season, infected fruits often being severely distorted. Ring spot and rough skin show later in the year and do not cause distortion (ATKINSON).

STANCOVIC: Is there something known about the influence of ecological conditions on the development of rough skin?

Answer: Rough skin symptoms have been found every year under often quite different conditions. Only this year few clear symptoms can be found, probably as a result of the warm and dry summer.

T. Pl.ziekten 62 (1956): 49-50

THE LEAF ROLL VIRUS DISEASE OF SWEET CHERRY

BY

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The presence of leaf roll disease (POSNETTE, 1955) in three orchards in Kent has been confirmed by graft transmission; this is at present the only means of clearly distinguishing the disease from those caused by other lethal pathogens, such as *Armillaria mellea* and *Pseudomonas mors-prunorum*.

SYMPTOMS ON DIFFERENT HOSTS

Upward rolling of leaves has been a constant symptom on all varieties inoculated, including Bing, Early Rivers, Hedelfingen, Schrecken Bigarreau and F12/1. A severe bark necrosis and gumming at the point of inoculation have been characteristic reactions of F12/1; this results in the death of the stem above the inoculation point and strong suckering from below it. Swellings develop on the two-year-old and older stems of F12/1, apparently caused by the breakdown of the medullary rays to form gum-filled pockets. Leafing and flowering of F12/1 and Early Rivers are delayed in the spring. Flower pedicels are short, many being only half the length of those on healthy trees.

Mature orchard trees of Early Rivers may be killed within 3 years of the first appearance of symptoms. (These symptoms were illustrated by lantern slides).

When inoculated in the glasshouse in May or June, young seedlings of peach and apricot were severely stunted, and died in the following year. Myrobalan seedlings developed leaf rolling but were not otherwise severely affected.

COMPARISON WITH OTHER VIRUS DISEASES

No virus disease rapidly lethal to sweet cherry has been reported in Europe. Four diseases somewhat similar to leaf roll have been reported in North America (Buckskin or Western X disease, necrotic rusty mottle, Lambert mottle and twisted leaf), but none of these closely resembles leaf roll. Buckskin is as severe as leaf roll only in trees on mahaleb stocks, but all the known cases of leaf roll are on mazzard stocks. Necrotic rusty mottle and Lambert mottle cause distinctive leaf symptoms absent from trees infected with leaf roll. The degree of leaf twisting caused by leaf roll in Bing is much less than with the twisted leaf disease.

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DISCUSSION

ATKINSON: Is the curling of Bing stem growth accompanied by anything approaching rubbery wood?

Answer: This is not the case. Real rubbery symptoms have not been detected in cherries infected with leaf roll.

FITZPATRICK: How widespread is the disease in England?

Answer: The disease has been found in three orchards in Kent, well separated one from the other. So there is no obvious connection between the different cases.

MULDER: Will it not be difficult to separate this leaf roll and bacterial canker symptoms in the trees on first view?

Answer: Indeed, when the trees show severe bacterial canker it is impossible to tell if they are also infected by the leaf roll virus without transmission tests. But even when bacterial canker is absent, leaf roll infection causes considerable gumming from slits on the bark and main branches. However there are no actual cankers, so that is a distinction. This is characteristic for Early Rivers, but it is not certain that other varieties react in the same way.



FIG. 1. 3-year old Early Rivers sweet cherry on F12/1 stocks. Left: healthy; right: infected leaf roll (second year after inoculation)

Photo East Malling Research Station



FIG. 2. Cherry leaf roll in May. Left: infected Early Rivers with delayed leaves and flowers; right: healthy Early Rivers

Photo East Malling Research Station



ABB. 1. Stecklenberger Krankheit der Sauerkirsche. Blattrosettenbildung an Zweigen eines stark erkrankten Baumes der Sorte 'Schattenmorelle'



ABB. 2. Stecklenberger Krankheit der Sauerkirsche. Mosaikscheckung und Ringfleckenbildung ('Schattenmorelle')



ABB. 3. Stecklenberger Krankheit der Sauerkirsche. Blättchenförmige Enationen auf der Blattunterseite ('Schattenmorelle')



ABB. 4. Mechanische Übertragung der Stecklenberger Krankheit der Sauerkirsche auf *Cucumis sativus* ('Delikatess')

DIE 'STECKLERBERGER KRANKHEIT', EINE BISHER NICHT BEOBACHTETE VIRUSKRANKHEIT DER SAUERKIRSCH

VON

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Während über das Vorkommen von Viruskrankheiten des Stein- und Kernobstes in Südwest-, West- und Nordwestdeutschland bereits seit mehreren Jahren berichtet wird (KOTTE, 1951, BÖMEKE, 1952, KUNZE, 1953 und 1954, THIEM, 1935), lagen aus dem mitteldeutschen Raum bisher noch keine experimentell gesicherten Befunde über das Auftreten von Obstvirosen vor. Veranlassung Untersuchungen in dieser Richtung aufzunehmen, gaben uns Beobachtungen über Absterbeerscheinungen und Ertragsrückgänge in größeren geschlossenen Sauerkirschenanlagen am nördlichen Harzrand. Die Ursache dieser Depressionen war uns zunächst unbekannt, das Krankheitsbild ließ jedoch das Vorliegen einer Virose nicht ausgeschlossen erscheinen.

In den bisher zweijährigen Untersuchungen konnten wir das Vorkommen folgender Kern- und Steinobstvirosen in Mitteldeutschland feststellen und durch Übertragungsversuche nachweisen:

Mosaik auf Apfel (*Malus pumila*), Bandmosaik (Line pattern) auf Pfirsich (*Prunus persica*), Bandmosaik (Line pattern) auf Pflaume (*Prunus domestica*), Ringfleckkrankheit (Ringspot) auf Süßkirsche (*P. avium*), 'Stecklenberger Krankheit' auf Sauerkirsche (*P. cerasus*).

In diesem Referat soll nur auf letztere näher eingegangen werden, da sie nicht nur die für unser Gebiet bisher wirtschaftlich wichtigste Viruskrankheit des Steinobstes ist, sondern auch mit keiner der bisher beschriebenen Virosen von *Prunus cerasus* identifiziert werden konnte. Wir bezeichnen diese Viruskrankheit nach dem ersten Fundort und dem Gebiet ihrer bisher stärksten Verbreitung als 'Stecklenberger Krankheit' der Sauerkirsche.

Symptomatologie: Ältere Bäume weisen im fortgeschrittenen Stadium der Erkrankung eine starke Hemmung des Triebwachstums auf, die Länge einjähriger Triebe betrug bei kranken Bäumen 5,6 cm gegenüber 10,3 cm bei gesunden Bäumen gleichen Alters am selben Standort (Mittelwerte von je 200 Messungen). An den gestauchten Trieben sitzen Rosetten kleiner, schmaler Blätter, die lederig verdickt sind und oberseits fettig glänzen. Die Blattränder können nach der Mitte und aufwärts gewölbt sein, die Ableitung der Assimilate aus den Blättern kranker Bäume ist offenbar gehemmt. Mit der Jodprobe ließ sich eine Stärkeanhäufung im Palisaden- und Schwammparenchym nachweisen. Auf den ältesten Blättern treten häufig ringförmige, braune oder rotbraune Nekrosen auf, die später ausbrechen können. Auf den jüngeren im Frühjahr gebildeten Blättern ist eine hellgrüne-gelbliche Sprenkelung, in der sich vielfach gezonte dunkelgrüne oder gelbe Ringflecke finden, bis zum Abschluß der Vegetationsperiode sichtbar. Symptomlos blieben in der Regel die

Blätter des Johannistriebes. Ein weiteres Kennzeichen sind die meist nur an wenigen Blättern auftretenden Enationen auf der Blattunterseite, die morphologisch und anatomisch dem Bau eines Laubblattes entsprechen. Über Enationenbildung an Sauerkirschen ist auch von THIEM (1953) berichtet worden. Ringfleckenbildung und Enationen können gemeinsam an kranken Bäumen vorkommen, häufig findet man aber auch nur eines dieser Merkmale. Charakteristisch ist, daß die Blattsymptome nicht in jedem Jahr auftreten und daß einem für die Viren der Ringspot-Gruppe bekannten 'Schockeffect' auch bei der vorliegenden Virose eine sich über mehrere Jahre erstreckende Periode der Symptommaskierung mit weitgehender 'recovery' der erkrankten Bäume folgen kann. Welche Faktoren die Ablösung der chronischen Krankheitsphase durch ihr akutes Stadium bedingen, ist noch nicht bekannt, möglicherweise ist der Witterungsablauf hierfür von Bedeutung.

Erkrankte Bäume weisen vielfach eine Verkümmern der Blütenknospen auf, gekennzeichnet durch Steckenbleiben der Knospen im Frühjahr und späteres Vertrocknen und Abfallen. Wenn sich vereinzelte Knospen entfalten, fehlen den Blüten die Petalen, das Gynaeceum ist verkümmert und die Blütenstiele sind verkürzt. Die für Frostschäden charakteristischen Gewebeverbräunungen (FISCHER, 1953) im Bereich der Knospenbasis konnten nicht festgestellt werden. In den meisten Fällen ist die Knospenverkümmern auf einzelne Äste des Baumes beschränkt, an diesen Bäumen sind auch stets andere Kennzeichen der Viruskrankheit zu finden. Nach experimenteller Übertragung wiesen zweijährige Sauerkirschen ('Schattenmorelle') die Knospenverkümmern in unterschiedlichen Ausmaß auf, besonders deutlich war sie an Bäumen, die nach der Infektion im Spätherbst zurückgeschnitten worden waren. Auf wilden Trieben der Unterlage erkrankter Bäume können gelegentlich Symptome auftreten, auf *Prunus mahaleb* eine kräftig gelbe Bandmosaik- oder Ringfleckenbildung, auf *P. avium* Sämling eine mehr diffuse schwachgelbe Scheckung mit braunroten Nekrosen, die später ausbrechen. Die Symptome bleiben bei beiden *Prunus*-Arten auf die ältesten, im Frühjahr gebildeten Blätter beschränkt.

Am häufigsten befallen fanden wir die in Mitteldeutschland meist angebaute Sorte 'Schattenmorelle', daneben auch kranke Bäume der Sorten 'Diemitzer Amarelle', 'Königliche Amarelle', 'Leitzkauer', 'Nordmann', 'Köröser', 'Pandy's' und eine russische Sauerkirschenunterlage. 8–10-jährige Bäume weisen nach unseren bisherigen Feststellungen ebenso starke Schädigungen auf wie doppelt so alte. Das Auftreten der Krankheit ist auch unabhängig von der Art der verwendeten Unterlage (*Prunus mahaleb*, *P. avium*-Sämling oder *P. cerasus*).

WIRTSCHAFTLICHE BEDEUTUNG

Der Krankheit muß eine große wirtschaftliche Bedeutung zugeschrieben werden, sie ist in weiten Teilen Mitteldeutschlands verbreitet und im Hauptbefallsgebiet (Stecklenberg) sind etwa 70–80% des Baumbestandes der 12–15-jährigen Anlagen erkrankt. Im Laufe der drei-jährigen Beobachtungszeit sind etwa 5% der erkrankten Bäume abgestorben, die stark befallenen weisen erhebliche Ertragsminderungen auf. Wahrscheinlich ist der größte Teil der kranken Bäume bereits infiziert aus den Baumschulen verpflanzt worden. Ob auch innerhalb der Anlagen eine Ausbreitung der Krankheit stattfindet, müssen weitere Untersuchungen zeigen.

Übertragungsversuche: Diese Versuche wurden auf dem Versuchsfeld des Institutes für Phytopathologie in Aschersleben durchgeführt. Im August 1953 wurden 10 zwei-jährige Sauerkirschen der Sorte 'Schattenmorelle' mit Augen erkrankter Bäume aus Stecklenberg okuliert, 16 zwei-jährige Bäume der gleichen Sorte und Herkunft dienten als Kontrollen. Es wurden je Baum 3 Augen, und zwar in den Haupttrieb und zwei Seitenäste, eingesetzt, die nicht in allen Fällen anwuchsen. Keines der Augen trieb im Frühjahr aus. Neben Verzögerung im Frühljahrsaustrieb zeigten sich im Mai an 8 von den 10 infizierten Bäumen Enationen, später Blattdeformationen, an einigen Blättern Gelbscheckung und bei 3 Bäumen Triebstauchung. Nekrosen und typische Ringflecke konnten in diesem ersten Übertragungsversuch nicht beobachtet werden. Im August 1954 wurden 13 drei-jährige Schattenmorellen mit Augen der drei am stärksten geschädigten Bäume des ersten Übertragungsversuches okuliert. Bei allen zeigten sich 1955 starke Enationenbildung, daneben Knospenverkümmern, geringe Blattentwicklung, Hemmung des Triebwachstums und nekrotische Ringe auf den ältesten Blättern sowie eine Mosaikscheckung mit gezonten Ringflecken auf den jüngeren im Frühjahr gebildeten Blättern. 5 mit Augen gesunder Bäume okulierte Schattenmorellen zeigten keine Symptome und wiesen normales Wachstum auf. Durch die Entwicklung eines starken Johannistriebes verwischten sich die anfänglich deutlichen Wachstumshemmungen der kranken Bäume gegen Ende des Sommers. Die Schattenmorellen des ersten Übertragungsversuches wiesen in diesem Jahr eine weitgehende Symptommaskierung auf, nur vereinzelt fanden wir Enationen. 16 zwei-jährige Schattenmorellen wurden im August 1954 mit Augen von stark erkrankten Bäumen aus Stecklenberg, die Ringflecken- oder Enationenbildung gezeigt hatten, okuliert. 13 zeigten im nächsten Jahr (1955) starke Schädigungen, gekennzeichnet durch verspäteten Austrieb im Frühjahr, Absterben einiger Äste, meist oberhalb der Okulationsstelle, Wachstumshemmung, Ringflecken und Enationen. In diesem Versuch konnte auch nachgewiesen werden, daß scheinbar gesunde Bäume latente Träger der Krankheit sein können. Von 7 Anfang Mai 1955, während des Austreibens durch 'chip-budding' infizierten Schattenmorellen wiesen 6 schon Ende Juni Ringflecke, Mosaikscheckung und Absterben junger Triebe oberhalb der 'chips' auf. Enationen wurden hier während der Vegetationsperiode nicht mehr gebildet. In der selben Weise wurden 29 drei-jährige Sämlinge von *Prunus avium* kurz vor dem Austrieb 1955 infiziert, 18 zeigten 6–8 Wochen später Symptome in Form von Gelbscheckung und starker Nekrosenbildung. Auch im Gewächshaus traten an 12 von 24 zwei-jährigen *P. avium*-Sämlingen, die im August 1954 mit Augen erkrankter Schattenmorellen okuliert worden waren, 3–4 Wochen nach dem Austrieb, im März 1955, Enationen, chlorotische und nekrotische Flecke oder Bänder auf den ältesten Blättern auf. Die Sämlinge waren nach Überwinterung im Freiland im Februar ins Gewächshaus geholt worden. Die Virose ließ sich von diesen Sämlingen im Gewächshaus durch 'chip-budding' im März weiter übertragen, wobei auf den ersten austreibenden Blättern der nach der Infektion zurückgeschnittenen Sämlinge von *P. avium* Anfang Mai Symptome erschienen, allerdings trat auch hier, wie bei den im Frühjahr infizierten Schattenmorellen, keine Enationenbildung auf. Auch zwei-jährige Sämlinge von *Prunus persica* konnten durch Okulation mit Augen kranker Schattenmorellen im August oder durch 'chip-budding' im Frühjahr, während des Austriebes, infiziert werden. Kurz nach der Entfaltung der Blätter

erschieden auf den basalen Blättern der unteren Triebe kleine gelbe Ringflecke, die allmählich eine, die Blattspreite teilweise erfassende, Gelbfleckung bildeten. Die Symptome blieben auf die älteren Blätter beschränkt, später zuwachsende zeigten sie nicht mehr. Mit 'chips' von diesen Pfirsichen wurden wiederum Sämlinge von *Prunus persica* kurz vor dem Austreiben, im März 1955, infiziert. Symptome erschienen hier schon 12–16 Tage nach der Infektion. Bei Übertragung von *Prunus avium*-Sämlinge auf *Prunus persica* betrug die Inkubationszeit im Frühjahr etwa vier Wochen. Alle Versuche mit *Prunus persica* wurden im Gewächshaus durchgeführt, wohin die getopften Sämlinge nach Überwinterung im Freiland im Februar gebracht worden waren.

Das Virus ließ sich durch Saftverimpfung von *Prunus cerasus* und *P. mahaleb* auf *Cucumis sativus* und von hier auf die gleiche Pflanze in 5 aufeinanderfolgenden Infektionsreihen übertragen. Die ersten Abreibungen wurden mit einem aus den noch nicht geöffneten Schattenmorellknospen, nach Entfernen der derben Knospenschuppen, hergestellten Preßsaft Ende April vorgenommen. In den zwei ersten Übertragungsreihen, Ende April und Anfang Mai kollabierten fast alle Pflanzen etwa 7–10 Tage nach der Infektion und starben ab. In den beiden nächsten, Mitte Mai bis Mitte Juni abgeriebenen Serien erschienen 6–7 Tage nach der Infektion gelbe diffuse oder ringförmige Flecke auf den Kotyledonen und gelegentlich Ringflecke oder Adernaufhellungen auf dem meist stark deformierten ersten Blatt, häufig starb der Vegetationspunkt ab. Ab Anfang Juli, in der 5. Übertragungsreihe, zeigten sich nur noch schwache Adernaufhellungen am Rande des ersten Blattes, nach dem 20. Juli gelang die Übertragung nicht mehr. Der Infektionserfolg lag nach Abreibung von *Prunus mahaleb*- und *Cucumis sativus*-Preßsäften bei 50–70 %, bei Preßsäften aus Schattenmorellenblättern bei 10 %. Mit Preßsaft aus Blättern von *Prunus avium*-Sämlingen oder Blütenblättern von Schattenmorellen (MCWHORTER, 1953) sind bisher keine Übertragungen gelungen.

Der Preßsaft wurde mit Phosphatpuffer nach Sörensen, pH 6, hergestellt und die Gurkenkotyledonen unter Verwendung von Carborund kurz vor der Entfaltung des ersten Blattes abgerieben. Temp. 18–24°. Das Virus konnte von kranken Schattenmorellen oder infizierten Gurkenpflanzen nicht auf *Nicotiana glutinosa* und *Phaseolus vulgaris* ('Early Giant' und 'Bountiful') übertragen werden, auch Rückinfektionen von diesen Pflanzen auf *Cucumis sativus* verliefen negativ.

Die auf *Cucumis sativus* hervorgerufenen Symptome sind den von WILLISON (1951) und BÖYLE, MOORE und KEITT (1954) nach Übertragung einiger Steinobstviren (Cherry yellows und necrotic ring spot, Tatter leaf, Prune dwarf) auf Gurke erzielten Krankheitsbildern ähnlich. Das, möglicherweise durch Temperatur- und Belichtungsverhältnisse verursachte, Variieren der Symptome in den verschiedenen Übertragungsreihen wurde auch von MULDER (1954) bei der Übertragung der in Holland gefundenen Form des Sour cherry necrotic ring-spot virus auf Gurke beobachtet.

Abschließend kann festgestellt werden, daß die in Mitteldeutschland auftretende Sauerkirschenvirose zwar einige gemeinsame Symptome mit dem amerikanischen Sour cherry necrotic ring spot (BERKELEY und WILLISON, 1948; WILLISON, BERKELEY und CHAMBERLAIN, 1948) und seiner in Holland (MULDER, 1954 u. 1955) gefundene Form aufweist (Nekrosenbildung auf den ältesten

Blättern, 'Shockeffect' und anschliessende 'recovery', Möglichkeit der Saftübertragung auf *Cucumis sativis*), sich aber durch die Bildung von Enationen und die während der ganzen Vegetationsperiode auftretende Mosaikscheckung und Ringfleckbildung von beiden unterscheidet.

Wir müssen vorläufig annehmen, daß die 'Stecklenberger Krankheit' entweder durch eine besondere Form des Sour cherry necrotic ring spot virus verursacht wird, oder durch einen Virus-Komplex, dessen eine Komponente das necrotic ring spot virus ist. Weitere Versuchen müssen darüber Aufschluss geben, ob einer zweiten Komponente dieses Komplexes die Enationenbildung zuzuschreiben ist.

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DISCUSSION

PANJAN: Did Dr BAUMANN succeed in getting symptoms in cucumber with mild strains of the virus?

Answer: No research on various strains of the virus has been done up to now, so that it is not yet known whether there are strains at all.

CADMAN: Could cherries be infected by sap inoculation with infective cucumber sap and were any other testplants, other than *Nicotiana glutinosa*, tried?

Answer: Infection back from cucumber to cherry has not yet been tried. Some species belonging to the Rosaceae, as *Filipendula*, *Potentilla* and *Geum* and also *Campanula* and *Dianthus*, have been infected, but no symptoms appeared up to now.

In America so far they have been also unsuccessful in attempts to transmit necrotic ring spot from cucumber back to sour cherry or peach (BERKELEY).

Dr YARWOOD succeeded in transmitting by sap the apple mosaic from apple to cucumber and back again, when maintaining a special Ph. (THUNG).

THRESH: From what species was the necrotic ring spot inoculum taken, that infected cucumber?

Answer: From *Prunus mahaleb* and from *Prunus cerasus*.

FITZPATRICK: Was the inoculum taken from the leaves?

Answer: From the leaves and from the petals and flowers (method McWHORTER). Inoculum from petals and flowers however gave no results.

POSNETTE: How many years do the enations develop on the sour cherry?

Answer: They may occur in one year and not in the next year. Sometimes however the enations are present during two-four years, but this is not usual.

POSNETTE: Do the enations always develop in the first year after infection?

Answer: Yes, in general they do. In the second year you can find only some trees with very few enations.

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UNE VIROSE GRAVE DU PRUNIER EN YOUGOSLAVIE

PAR

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Pour l'arboriculture Yougoslave un problème grave est posé par l'existence d'une virose du prunier qui a pris une grande extension et a sérieusement atteint la production de cette espèce fruitière dans de vastes régions. La virose en question est le 'plum pox' (Šarka) causée, d'après CRISTOFF (1947), par *Prunus virus 7* (*Annulus pruni*).

Cette maladie a été pour la première fois signalée en 1932 par ATANASOFF en Bulgarie, et en 1936 par nous en Yougoslavie. Les enquêtes ultérieures détaillées ont montré qu'elle se trouve répandue dans la plus grande partie aussi bien de Bulgarie que de Serbie et de Macédoine, ainsi que dans plusieurs régions de Monténégro et de Bosnie. On évalue actuellement, seulement en Yougoslavie, à plus de onze millions de pruniers atteints par cette virose, dont un nombre important à un degré avancé. La variété la plus sensible, est le Prunier de Hongrie (Požegača yougoslave, Čustendilka bulgare), qui est en même temps la variété principale et économiquement la plus importante dans les Balkans.

Les conséquences nuisibles du 'plum pox' se manifestent surtout sur les fruits. La mosaïque que l'on observe sur les feuilles reste bénigne, les sujets atteints sont d'un développement et de longévité normale. Aussi le virus n'exerce aucune influence défavorable sur la floraison et la fécondation. En ce qui concerne les fruits, ceux-ci commencent à tomber en masse dès la véraison et un nombre plus ou moins grand de ceux qui restent sur l'arbre, mûrissent prématurément et sont très fortement dépréciés. Ils ont un aspect chagriné, avec des rides circulaires ou sémi-circulaires profondes. La chair, riche en gomme, a par place une couleur brun-rougeâtre et est d'un goût tellement désagréable qu'elle

devient immangeable et impropre à production aussi bien des pruneaux que de la marmelade. La perte et la dépréciation des fruits sont d'autant plus grandes que l'arbre a été pendant plus longtemps contaminé par le virus.

D'après ATANASOFF et CHRISTOFF, le 'plum pox' virus serait transmissible par *Anuraphis padi*. Considérant cet insecte comme agent principal de propagation de la virose, ces auteurs avaient préconisé pour combattre cette dernière la suspension de nouvelles plantations du prunier dans des régions à 'plum pox' et la destruction aussi vite et aussi complètement que possible, de tous les pruniers malades ainsi que de tous les sujets atteints de *Prunus insititiae*, *P. myrabolana*, *P. armeniaca* et *P. triloba*, comme capables d'héberger le même virus.

Cependant, ce mode de lutte, ne serait pas, d'après nous, bien fondé, car il nous paraît que l'importance d'*A. padi* dans la propagation du 'plum pox' a été exagérée par les auteurs bulgares. Nos observations ainsi que les données que nous avons pu recueillir en Yougoslavie au cours des quinze dernières années, nous permettent de conclure que cet insecte, vecteur possible du 'plum pox' virus dans des conditions expérimentales, est très peu actif dans la nature. On pourrait même le considérer comme tout à fait inactif, au moins dans certaines de nos régions.

Nous avons pu établir dans de nombreux vergers, où existait un plus ou moins grand nombre de pruniers malades, que la maladie n'a pas progressé au cours des 10 à 15 dernières années. Aussi des prunelaies, âgées de 20 à 30 ans, se trouvaient côte à côte, les unes sérieusement atteintes, les autres absolument exemptes de la virose. Dans un même verger, près des pruniers manifestant les symptômes prononcés de 'plum pox' existent toujours les arbres apparemment indemnes, bien qu'il s'agisse de la même variété sensible (Prunier de Hongrie).

Pour compléter ces constatations, une enquête menée par nos collaborateurs (PERIŠIĆ et autres en juillet 1953, en Serbie de l'Ouest, arrondissement de Krupanj), a permis de déterminer que la virose a commencé à se propager à partir de 1936, par les plants produits dans la pépinière d'Etat de Krupanj. Ces plantes provenaient des pieds-mères en provenance de la Serbie de l'Est, où l'affection est très répandue. Grâce aux documents officiels de la pépinière il était possible de trouver les noms des arboriculteurs des environs auxquels on a fourni les plants malades depuis 1936. La visite des vergers de ces arboriculteurs a permis de constater que seuls les pruniers provenant de la pépinière étaient atteints de 'plum pox'. Par contre, les sujets, d'origine locale, sans exception, étaient demeurés sains, bien qu'à côté d'eux se trouvaient, dans certains cas presque 17 ans, des arbres malades. On peut en déduire que la virose ne s'est pas propagée dans le pays malgré la présence prolongée des sujets malades et l'existence d'*Anuraphis padi*.

Des constatations analogues ont été faites par nos collaborateurs dans une ville balnéaire (Koviljača), qui se trouve dans une région à prunier de la Serbie de l'Ouest où le 'plum pox' est absent. Là, cette virose a été constatée uniquement dans les jardins des villas et dans un verger dans la proximité, dont les propriétaires s'étaient procurés des plants des différentes pépinières de la Serbie de l'Est. Certains des pruniers trouvés infectés de la virose étaient âgés de 30 à 40 ans. Ici aussi, la propagation de la maladie n'a pas eu lieu malgré sa longue existence dans le pays.

D'après ces données, on peut se demander, si le virus de 'plum pox' n'est pas

transmis par les insectes, alors comment expliquer sa grande extension aussi bien en Yougoslavie qu'en Bulgarie.

La réponse à cette question, d'après nous, il faut chercher dans les deux faits suivants: 1) dans l'origine lointaine de la maladie dans les Balkans et 2) dans le mode tout particulier de la multiplication du prunier pratiqué dans les deux pays.

Il nous paraît certain, que le 'plum pox' chez nous, est une maladie ancienne. Suivant les témoignages précis, elle a été déjà bien répandue au début de ce siècle en Serbie de l'Est. Par conséquent, l'époque de son apparition doit être bien éloignée.

D'autre part, le prunier est multiplié presque exclusivement par drageons. Plus de 95% de prunelaies ont été ainsi constituées. Ce mode de multiplication, poursuivi de génération en génération, a rendu possible l'augmentation dans des proportions toujours grandissantes, du nombre des sujets malades. Le transport des plantes malades, d'autre part, d'une région à l'autre, a permis une rapide extension territoriale de la maladie.

De tout cela nous croyons pouvoir tirer la conclusion suivante. La propagation du 'plum pox' en Yougoslavie est assurée principalement, si non exclusivement, par la voie végétative. La participation d'*Anuraphis padi*, ou de tout autre insecte, dans cette propagation peut, de ce fait, être considérée comme peu importante ou même négligeable.

Grâce à ces circonstances, la lutte contre le 'plum pox' nous paraît facilement réalisable, en n'employant que des plants saines et en procédant en même temps à l'élimination progressive des arbres actuellement malades, sans attendre toutefois la disparition de ceux-ci pour entreprendre la plantation de nouvelles prunelaies.

SUMMARY

1. The propagation of the plum in Yugoslavia and the spread of the virus disease plum pox is done by the use of suckers. The role of *Anuraphis padi* as the vector of plum pox virus is of very little importance, especially in some districts of Serbia.
2. The symptoms of plum pox are not always the same. The losses of the crop varies from one year to another and also the number of fruits which have morphological, chemical and physiological changes is not the same always. In some years the number of diseased fruits is smaller and then the crop is almost normal; the causes of these variations are of climatic origin; they very probably depend upon temperature but precise data on this subject must be collected.
3. Sometimes the symptoms of plum pox can be masked completely. A tree which is diseased this year can be symptomless the next year.
4. In many cases the symptoms of plum pox remain localised in some part of the crown for a long time. Very often they appear only on a few branches. On the other hand, the same branch can show clear symptoms in one year and none in the next. Sometimes the suckers of the stem show symptoms but other parts of the tree show none.

These observations are made on the most sensitive variety 'Pozegaca' in the State of Serbia and Macedonia.



FIG. 1. Les feuilles du Prunier de Hongrie avec les symptômes de 'Sarka' ('Plum pox')

FIG. 2. Les fruits du Prunier de Hongrie avec les symptômes de 'Sarka' (Plum pox')

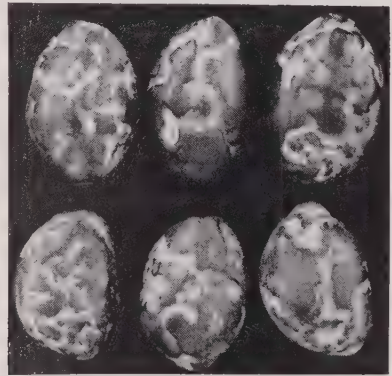


FIG. 3. Les symptômes de 'Sarka' ('Plum pox') à l'intérieur d'un fruit du Prunier de Hongrie

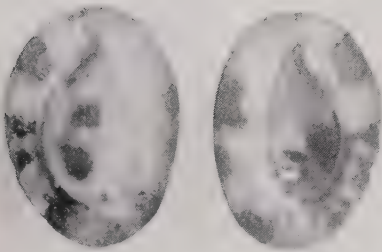




FIG. 1. Rameau à feuilles enroulées au milieu des feuilles normales; premier symptôme (Perpignan, juin 1954)



FIG. 2. Fruits d'arbres dépérissants (ridés, face interne lignifiée et brunie) – Au premier plan fruits sains



FIG. 3. Feuillaison prématurée partielle (Perpignan, 15 mars 1953). Bouquets de feuilles localisées sur certains rameaux au milieu de branches fleuries

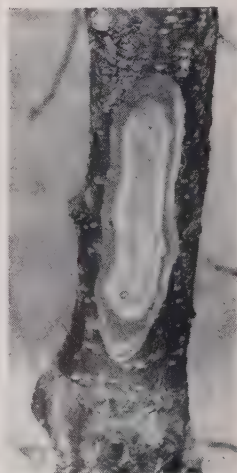


FIG. 4. Nécrose du Liber (Perpignan, mars 1955)

FIG. 5. Transmission expérimentale (greffé, juillet 1953; photographié en juillet 1954). Enroulement caractéristique – Remarquez les feuilles isolées au premier plan

Some of the causes of irregularity in the activity and behavior of plum pox virus are difficult to explain.

DISCUSSIONS

ATKINSON: Do the fruit symptoms of plum pox ever occur without leaf symptoms?

Answer: In general they always occur together, but sometimes the fruit symptoms may appear one or two years after the leaf symptoms. It is different on different varieties.

POSNETTE: Is it possible that plum pox is a more serious disease in Balkan countries than in other European countries, because the most sensitive variety (Pozegaca) is widely grown only there or because the temperature is higher? The leaf symptoms of plum pox, or something quite similar, seem to be widespread in Europe.

Answer: This may be partly due to the variety. The temperature is not of great influence.

Plum pox was recently found in Hungary and Czechoslovakia too (BAUMANN).

CIFERRI: Is there any experience in transmitting plum pox to other *Prunus* species?

Answer: Experiments in transmitting the disease to apricot and cherry had no results.

T. Pl.ziekten 62 (1945): 59-64

OBSERVATIONS RELATIVES AU DÉPÉRISSEMENT DE L'ABRICOTIER EN FRANCE

PAR

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ET

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Le dépérissement de l'Abricotier ou Apoplexie paraît atteindre, excepté l'Espagne, la plupart des pays producteurs d'Europe et, en outre, au moins le Maroc.

Quoique le problème ait été étudié depuis plus de trente ans, il y a une divergence complète dans l'estimation des causes. Les pays d'Europe centrale semblent avoir surtout considéré des facteurs écologiques et principalement la sensibilité particulière de l'abricotier au froid, conséquence soit de l'utilisation d'un mauvais porte-greffe, soit de conditions du sol défavorables.

Pour ces pays ces accidents pourraient être décrits brièvement comme suit: certains arbres qui jusqu'alors n'avaient pas été spécialement remarqués, présentent au printemps un débourrement retardé, le liber du tronc est gelé l'arbre se dessèche après un faible départ de la végétation. On rencontre par la

suite sur les branches des fructifications de champignons et en particulier de *Valsa*.

L'aspect du dépérissement est tout différent en France.

CHABROLIN l'avait déjà décrit et d'autres auteurs français quoique l'attribuant à des causes différentes, ont toujours cité sa description en référence. GOIDANICH en Italie soulignait les similitudes entre la leptonécrose du Prunier japonais – *Prunus salicina* – et de l'Abricotier.

I. CARACTÈRES GÉNÉRAUX DE LA MALADIE

La maladie apparaît en France comme nettement définie et présente une suite de symptômes relativement constante.

Contrairement aux indications de JOESSEL et en accord avec CHABROLIN et GOIDANICH le dépérissement nous paraît complètement différent de la Verticilliose que nous avons par ailleurs rencontrée.

Il se produit de façon similaire sur tous les porte-greffes couramment utilisés en France :

1. Prunier Myrobolan avec ou sans intermédiaire et prunier Reine-claude;
2. Pêcher;
3. Abricotier.

Nous prendrons cependant comme type le cas des abricotiers greffés sur prunier qui est le plus fréquent et celui où les symptômes sont les plus nets.

Excepté le cas de certains arbres greffés sur Pêcher qui présentent un dépérissement apoplectique extrêmement rapide, la maladie est très progressive et s'étend sur plusieurs années. Lorsque les arbres ont présentés les premiers symptômes, ils paraissent définitivement malades.

La maladie s'étend en foyer à partir de quelques arbres isolés. Elle est particulièrement grave dans la région (le Rousillon) où l'on utilise depuis la guerre comme porte-greffes des drageons récoltés au pied des arbres dans les vergers. Son développement récent dans cette région paraît avoir été la conséquence de ce changement de pratique. Au contraire dans les régions, où l'on utilise les porte-greffes fournis par les pépinières de multiplication, les arbres paraissent demeurer sains pendant les cinq premières années.

Sa fréquence est cependant toujours grande dans les zones où les vergers sont contigus. Environ trois ou quatre p. cent des arbres présentent chaque année les premiers symptômes et l'on peut trouver à un moment donné quinze p. cent des arbres à différents stades de dépérissement.

Il ne paraît pas possible de relever de différence fondamentale de fréquence suivant le sol l'irrigation ou le climat.

Par contre l'expression des symptômes secondaires est fortement influencée par le climat. La maladie paraît parfois évoluer moins vite lorsque les conditions culturales sont particulièrement favorables.

Seules quelques zones isolées où les arbres sont greffés sur semis d'abricotier semblent à peu près exemptes de la maladie.

II. LES SYMPTÔMES

Les premiers symptômes sont :

un enroulement des feuilles avec jaunissement ou éclaircissement irrégulier de la couleur de la feuille entre les nervures, au cours de l'été ;

un brunissement de la chair du fruit au contact du noyau au moment de la maturité, ou une maturité plus précoce.

Le caractère pathologique principal est le développement de feuilles au cours de l'hiver même lorsque la température descend un peu au dessous de zéro.

L'avance de végétation faible la première année (développement simultané des feuilles et des fleurs), s'accroît généralement l'année suivante. Les feuilles peuvent apparaître dès le mois de Novembre. Dans ce cas les arbres perdent leurs feuilles plus tôt.

Lorsque le feuillage est complètement développé au moment de la floraison, les arbres ne portent aucune fleur.

Sur les arbres de plus de cinq ans environ, les symptômes sont d'abord localisés sur quelques branches et s'étendent les années suivantes sur l'ensemble de l'arbre.

On constate un brunissement du liber qui paraît être l'effet du froid sur des tissus en végétation.

La mort des branches se produit lorsque ces lésions s'étendent jusqu'au cambium et le détruisent, mais si le tronc n'a pas été trop atteint il y a des repousses qui peuvent être vigoureuses et sans caractère pathologique. Lorsque le porte-greffe est un prunier celui-ci forme des drageons dès qu'une partie de l'arbre commence à se dessécher. Ces drageons sont beaucoup plus rares avec les autres porte-greffes.

En présence de froids plus rigoureux certaines branches semblent être gelées avant d'être entrées visiblement en végétation alors que normalement les nécroses se limitent aux branches qui portaient des feuilles lorsque sont survenus les froids. Dans ce cas au printemps la maladie se traduit plutôt par un retard de la végétation, due au départ différé de bourgeons latents après le gel des bourgeons normaux. Au cours du printemps et du début de l'été ces arbres séchent en général complètement. Cet aspect semble se rapprocher des accidents d'apoplexie décrits en Europe centrale.

Les arbres agés, malgré la présence des mêmes symptômes, résistent beaucoup mieux et survivent longtemps.

En l'absence de grands froids et sans nécrose du liber importante, il se produit des cas d'apoplexie avec enroulement de feuilles, pousses courtes grêles et court-nouées, mort des bourgeons à la base des pousses, départ de tous les bourgeons de l'extrémité des branches.

III. ESSAIS DE TRANSMISSION

L'homme peut être un agent actif de dissémination quand il utilise comme porte-greffe des drageons ramassés dans les vergers d'abricotiers, parce que ceux-ci se forment principalement au pied des arbres dépérissants. La fructification précoce et importante, souvent observée sur des arbres qui dépériront l'année suivante a pu inciter des producteurs à choisir des arbres déjà malades. Au cours des prospections réalisées par la Station de la Grande Ferrade de 1947

à 1951 sur dix-huit types repérés en 1948 comme précoces et régulièrement observés ensuite, onze étaient morts de dépérissement ou dépérissants en 1950.

Un fait orienta les recherches dans le sens d'une maladie transmise ou conservée par la greffe. L'arbre original d'une nouvelle variété du Roussillon est mort de dépérissement peu de temps après le prélèvement des greffons. Le dépérissement a sévi d'une façon si intense parmi les 250 descendants qu'ils durent être arrachés sept ans après la plantation.

1. Etude sur la conservation de la maladie dans le scion par écussonnage de greffons malades sur porte-greffes sains. Ces essais ont été faits sur le même sol que celui où sont situées les pépinières et les collections de la Station.

Greffons malades placés sur	Date	Nombre de greffes	Greffes réussies	Malades	Morts, séchés (apoplexie)	Normaux	Observation faites après
Abricotier (2ème pousse)	juin '47	33	27	5	13	9	4 ans
Pecher de semis	juin '50	45	30	9	8	13	1 mois et demi

2. Essai de greffage à partir d'un arbre apparemment sain et d'un arbre malade, issus tous les deux du greffage d'écussons provenant d'un même rameau d'un arbre malade (obtenus au cours de l'essai ci-dessus de 1947).

Origine des greffons	Nombre de greffes	Greffes réussies	Malades	Normaux	Remarques
arbre sans symptôme	10	8	2	6	mauvaise reprise due sans doute à la faible dimension des rameaux greffons
arbre avec symptôme	20	3	1	2	

3. Greffage d'arbres malades avec des greffons sains

nombre d'arbre greffés	scions malades	scions sains
28	11	17

4. Passage dans le sens porte-greffe-greffon sain:

Greffage d'un type sain sur:	malade	sain
myrobolan de semis	aucun	1800
dragons de reine-claude récupérés dans les vergers	20	1800

5. Ces essais ont été continué depuis 1952 en collaboration entre la Station de Pathologie végétale et la Station d'Arboriculture sur une plus grande échelle dans le Roussillon et à partir des environs de Lyon.

Jusqu'à présent seules les greffes faites en Août 1953 et en Mai 1954 ont

extériorisé des symptômes. Les résultats précédents ont été confirmés à partir d'écussons de différentes origines du Lyonnais et du Roussillon, et dans un cas la transmission du greffon malade au greffon sain est très nette sur tous les arbres obtenus à partir d'une seule source de greffons malades. Sur les autres arbres portant le même greffon sain (inoculés avec une autre source ou non-inoculés) il n'y a aucun symptôme.

CONCLUSION

Le dépérissement de l'Abricotier qui sévit d'une façon alarmante dans les principales régions de culture de l'Abricotier de France semble, bien que nos essais et observations ne soient pas encore suffisants, être une maladie complexe du type maladie à virus.

Si les essais de transmission de la maladie à un greffon ou à un arbre sain sont encore trop partiels, il apparaît un fait net. Le greffon issu d'arbre malade donne naissance à une pousse qui, après un départ généralement normal, présente les symptômes de la maladie.

Divers essais jusqu'alors négatifs ont été faits sur un certain nombre de prunus et d'hybrides interspécifiques de prunus en vue de rechercher une plante test.

Les observations en foyer suggèrent une transmission naturelle d'arbres malades à leurs voisins immédiats (peut être, par greffage naturel des racines) et avec une moindre fréquence à plus grande, distance.

SUMMARY

Dieback of apricot

A disease of unknown cause on apricot in France is described. The most important symptoms are:

1. Leaf roll and interveinal chlorosis.
2. An almost uniform browning of the tissue around the stone of the fruit.
3. Premature development of leaves in the course of the winter.

As a secondary symptom frost damage occurs in the bark of the twigs that produce leaves too early. A form of sudden death (apoplexy) seems to belong to the range of symptoms.

There is no correlation between soil condition and the frequency of the disease.

Transmission experiments were only recently set up and haven't yet given definite results. Trees grown from diseased budwood grafted onto apricot or myrobalan again show symptoms of the disease to a varying percentage.

Of 28 diseased trees grafted with healthy graftwood 11 showed symptoms on the new grafts. From one source transmission of foliar symptoms to healthy scions was observed.

The writers conclude that the disease seems to be of a complex virus nature.

DISCUSSION

CIFERRI: In Italy similar symptoms have been found in peach and probably

also in cherry, plum and apricot. These symptoms are quite evident in summer but are difficult to detect later in the season. The first and most important symptom is the phloem necrosis. Very many trees are affected. It was supposed that a virus disease was concerned, however experiments showed that this disease is not graft transmissible; the disease could be cured by heavy manuring.

MULDER: Is it sure that the diseases in France and Italy are identical? Has Dr SOUTY already carried out experiments on fertilisation?

Answer: It is not sure that the diseases in France and Italy are the same. In France manuring has no influence.

CIFERRI: Does a tree with phloem necrosis show this symptom every year afterwards?

Answer: No. The necrosis may be induced by frost.

CIFERRI: Will a new tree, planted after roguing an affected one, stay healthy?

Answer: Yes, the disease does not infect via the soil healthy trees planted on the site where affected ones were rogued.

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VIRUS SYMPTOMS ON ALMOND LEAVES IN SOUTHERN ITALY

BY

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Under the general name of 'mosaic' in 1943 a virus disease of almond (*Prunus amygdalus*) in Puglia region (Southern Italy) has been reported.

Up till now no further attention has been given to the disease, although almond trees represent, together with olive trees, grapevines and citrus, the main fruit crop of the same region. Presumably peculiar local conditions together with the fact that only rarely affected trees die, are at the base of this negligence.

The remarkable frequency of the symptoms of the disease on almond trees (in some districts we could calculate even a 40 percent of infected trees in the field) induced us to investigate the problem with more attention.

Not all almond varieties show the same degree of symptoms; some of them are heavily infected, but some others seem to be sufficiently tolerant and are symptomless.

In these first two years, our investigations were particularly directed towards collecting different symptoms on leaves of different almond varieties, which are extremely numerous in the Puglia region (about 300, the greater part of which still unknown.)

The ascertained variability in symptoms on each almond variety makes us presume that there may be a different reaction of each of them to the virus infection and, at the same time, that symptoms are made complex by the presence of many virus strains, so that a gradient in symptoms may be produced.

Moreover, it is to bear in mind that the symptoms are the ones collected only in a few almond districts of the region, but without any doubt their number will

still increase by extending the investigations to the other almond varieties in other districts of the same region.

It is in our program also to investigate the relations between virus infection and yield, as we could already ascertain that yield is particularly influenced in some varieties and in relation to only some symptoms. In some cases symptoms of the disease appear also on fruits (malformations, yellow patches, reduction in size, etc.). We hope to do more research regarding this point of view in the next future. On the other side, even if trees do not die, in most cases affected trees assume a diseased appearance in comparison with normal ones, presumably because of the reduction of chlorophyll in the leaves and of the fact that generally diseased leaves soon fall down and foliage is renewed in the same spring. It is easy to suppose that this can more or less and indirectly influence the yield of the infected trees. Variability in symptoms and the high number of cultivated varieties of almond makes this valuation extremely difficult.

The importance of these virus diseases of almond is to be considered also in relation to the actual and almost uncontrolled commerce of nursery plants which represents an important means of diffusion of these diseases. In this connection, we want to emphasize that on 110 nursery plants purchased three years ago from the Puglia region, 106 appeared next year infected and showed symptoms of the diseases.

SYMPTOMS

A slight stunting of the infected trees occurs after some years. Diseased trees have (particularly in early spring) a rosetted appearance due to the crowding of leaves on twigs with shortened internodes. Each of the leaf symptoms here reported were collected on a single tree on which it seems to be characteristic. Sometimes different symptoms appear on the same tree.

Probably it is possible to classify them schematically as follows:

1. Affected trees show a variable amount of foliage with yellow blotches in the leaf blade. The leaf shape is often abnormal. The yellow blotches become necrotic in a second stage. The first symptoms appear on the first formed leaves, when they are a few centimeters long as chlorotic pale green blotches, which then turn yellow and persist on the leaves throughout the season.
2. Vein and veinlet yellowing; frequently symptoms 1) appear on the same plants together with this symptom.
3. Affected trees show variable amounts of foliage with white blotches on the leaf blade. These blotches may become necrotic later. It is a not widely diffused symptom.
White spots limited only along the margins of the leaf blade may be considered as a more peculiar aspect of the same complex of symptoms.
4. Vein and veinlet whitening; like the symptoms described in 2), but white. Frequently on the same plant together with symptoms 3).
5. Line pattern; patterns on leaves usually consist of lines, bands, and oak-leaf patterns. The characteristic symptom is a fine, irregular and yellow or yellow-green band on each half lamina, usually forming a symmetrical pattern. Part of the yellow band tissue eventually becomes necrotic and either splits or drops out. 'Line pattern' occurs often on the same trees showing symptoms 1) and 3).

- On some 5-year-old trees of 'Catuccia' 'Fragiulio' and 'Rachele' varieties, which showed only symptoms 1) in 1953, next year these symptoms appear only in the early spring, while later in the season 'line pattern' was mixed with them; in 1955, at last, only a line pattern was visible on the same trees.
6. 'Ring-spot'; symptoms consist of yellow or yellow-green rings, spots and line patterns. Very often on the same leaves mixed with line pattern.
 7. A mosaic mottling; small yellow or yellow-green flecks on the leaf blade. There is a gradient of mosaic mottling. Leaves may assume irregular shapes.
 8. Irregular mottling, with chlorotic, yellow-green and brown spots (sometimes also with yellow-green streaks), usually accompanied by distortion and reduction in size of the leaf blade. Leaves may be also misshapen and the leaf blade generally wavy or undulating. Both mottling and distortion of leaves are more or less pronounced.
 9. A rusty mottle; yellow-brown or rusty spots, irregularly diffused on the leaf blade. This symptom occurs only on very few plants.
 10. Pale green or yellowish patches, which soon change to bright yellow or creamy-white on any part of the leaf. These patches may also become necrotic. No specific pattern is formed. Found only on very few plants.
 11. Sometimes we find a mixture of some of the symptoms reported above. Some leaves show symptoms recalling the ones described in the literature on almond leaves for 'yellow bud mosaic'; some of them recall also the symptoms reported on almond leaves experimentally infected with 'peach mosaic'. It is probably a mixture of different strains of a virus on the same tree. This mixture of symptoms occurs quite often.

EXPERIMENTAL TRANSMISSION

The first attempts to transmit the disease experimentally in Italy, were carried out in 1943; presumably they concern the symptoms 1), with the transmission of the same symptoms on healthy almond trees.

In our trials we tried transmission by grafting, using almond trees showing symptoms 1), but which only showed them together with 'line pattern' symptoms. Grafts were performed in 1953 on apricot (*P. armeniaca*), on plum (*P. domestica*), on sweet cherry (*P. avium*) and on peach (*P. persica*) trees. Next year the following symptoms developed on leaves near the grafting point:

- a) on apricot: line pattern and some ring-spots; the symptoms recall the ones reported in the literature as due to 'peach mosaic' experimentally transmitted on apricot.
- b. on plum: line pattern, or yellow-brown mosaic mottling.
- c. on peach: line pattern and irregular mottling.
- d. on cherry: no symptoms as grafts failed.

The incubation period seems to be 6-7 months. In only two years symptoms appear on all the branches of a 5-year-old plant.

Monosteira unicostata is probably to be considered as one of the insect vectors of this group of virus diseases, according to the observations that infected trees are, in the majority of cases, heavily infested.

In conclusion, the problem is just delineated and the program of work is

wide and complex. It is evident that different strains of a virus or of several viruses are present on the infected plants. It is possible also that most part of the symptoms described may belong to the 'line pattern' group of virus symptoms. This can be more accurately ascertained using indicator plants. In any case, at present, we are allowed to presume that almond trees have actually, in Italy, the highest percentage of virus infection of all stone fruit trees.

Generally, all symptoms described may disappear with the rise of temperature, so that in August the affected trees are symptomless.

May be also we can reach a classification of almond varieties according to the relative severity of their different symptoms.

Not yet investigated are the relations between leaf symptoms and the variability in leaf shape and size and leaf malformations, among which is also a certain number of bifid leaves that may be directly connected with virus infection.

From a practical point of view, there is a good possibility to reach the solution of the problem by selecting resistant varieties or only distributing the ones already cultivated in our almond growing regions that appear to have a remarkable resistance to virus infection.

DISCUSSION

POSNETTE: Have all those symptoms been transmitted?

Answer: Only some of them, as I emphasized in my lecture. Till now it was most important to know what symptoms and how many of them are present in Italy.

POSNETTE: Has the variegation been transmitted by grafting?

Answer: No, that variegation could not be transmitted up til now.

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THE PRESENT ASPECT OF FRUIT TREE VIRUS DISEASES IN SWITZERLAND

BY

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At the moment we know in Switzerland about a dozen virus diseases of fruit trees. Some of them are of considerable economic importance especially some virus diseases of apples.

Flat limb is very frequent in the varieties Gravenstein and Schneiderapfel. Besides, this disease occurs occasionally in the varieties Ontario, Glockenapfel and Tobiäslar. The yield of diseased trees may be very satisfactory at least during the first years. It is assumed that this fact is due to some difficulties in the downward movement of organic compounds.

The proliferation disease seems to be very frequent in nurseries but occurs also on fullgrown trees. The identification of this disease in the nursery is very difficult, because the prior growth of axillary buds may be caused by other factors

than by virus alone. There exist some varieties which show frequently a vigorous and acute-angled ramification and even the enlarged stipules are present. Nevertheless, the viruslike appearance of this trouble must be attributed to genetic factors in these varieties. In other cases the proliferation disease may appear the first year after budding and disappear completely in the second year. Finally, similar viruslike symptoms are caused by powdery mildew, aphids or by non parasitic troubles if the terminal bud is killed.

With these restrictions we must admit as true that the proliferation virus occurs very frequently in our nurseries and in the orchards. The variety Schneiderapfel used in Switzerland mainly as an intermediate is very susceptible to this virus and it will be the first aim to eliminate from this valuable variety both the flat limb and the proliferation disease.

Rough skin. This disease seems to be very wide-spread in Switzerland and causes serious loss of quality on several varieties, e.g. Boskoop, Reinette de Champagne, Ontario, Glockenapfel and possibly on Golden Delicious, Graevenstein and Staefner Rosen (Baldwin). Transmission experiments carried out by H. FISCHER will give definitive proof whether all these troubles are related to virus.

Further trials on the transmission of the *Pfeffinger disease* of sweet cherries showed that young trees planted close to diseased trees are infected after 2-3 years. On the other hand, we did not observe any transmission of the disease during 11 years, if potted trees were grown closely together. We can conclude from these trials and from different observations in orchards that transmission by root contact occurs very frequently, but there is little evidence for a transmission by insect vectors.

Prune dwarf on Italian Prune (Fellenberg) seems to be the most serious danger in this variety. A number of other varieties grafted on diseased Italian Prune showed no symptoms. Some others revealed different types of mosaic.

The typical symptoms of prune dwarf appeared only on the variety Ebersweier Frühzwetschge. The work with viruses on prunes and plums offers many difficulties because of the variability of symptoms on different varieties. Latent infections occur very frequently and therefore we have no proof that the rootstocks and varieties used in our experiments are really free from virus.

DISCUSSION

BERKELEY: Do the line pattern symptoms persist in prune dwarf infected trees showing line pattern?

Answer: On Italian Prune line pattern symptoms appear one year after infection, but they fade away in the second or third year if the trees are infected with prune dwarf at the same time. I never could find symptoms of line pattern on leaves which show the typical prune dwarf deformations. It is possible that the line pattern comes from the rootstocks.

TEN HOUTEN: Why does Dr BLUMER believe that Pfeffinger disease is not transmitted by an insect?

Answer: During eleven years two healthy trees among sixty diseased potted trees that were artificially infected stayed healthy although there is a number of cicadellids and other insects present in this plot.

TEN HOUTEN: It may be possible that the vector does not occur in Zürich,

whereas it may be present in the Basel area. In the Netherlands the same is the case with *Macropsis fuscus* on raspberries. This vector does not occur in the Wageningen plantations.

Answer: The Pfeffinger disease spreads in orchards at a distance of 3-4 km from our trials at Wädenswil. If for transmission an insect vector would be indispensable, it also should occur in Wädenswil. Besides it was tried in 1944 to introduce the vector from Pfeffingen, but without any success.

MULDER: Has Dr BLUMER indeed no proof of the virus nature of witches' broom disease? How long ago did he carry out his transmission experiments?

Answer: The experiments were carried out already four years ago; during this time I could not find any symptoms on rootstocks grafted with diseased scions. This is in contradiction with the Dutch result.

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RECENT PROGRESS IN FRUIT TREE VIRUS RESEARCH IN ITALY

BY

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Fruit culture in Italy is of the greatest economic importance. The area of specialized cultures of unmixed crops, was in the year 1953 of about 400.000 hectares for citrus, pomaceous and drupaceous plants, walnut, hazel-nut, carob and fig. The area of the olive trees (mixed and unmixed crops) is about 1.300.000 ha and that of grapevines, at all, about 4.000.000 ha.

In spite of the extensive culture of fruit trees, virus diseases are comparatively not very important, or at least their economic importance has not been ascertained, with a few exceptions. For instance, the virus diseases of cherry trees of almost universal distribution are not known in Italy. Nutrient deficiency diseases are apparently more important at least for some species (peach, cherry, citrus, olive, persimmon, and others), chiefly on the widely diffused cultures established on calcareous soils.

This is the reason why the studies of both groups of diseases are generally made by the same research workers, at least in the first phase of survey.

The objects of the most intensive research are actually:

- a. Apple and pear ('witches' broom'; B-deficiency);
- b. peach (K and P-deficiency);
- c. cherry (K and P-deficiency);
- d. almond (the complex of virus diseases);
- e. olive (B-deficiency and several virus or virus-like diseases);
- f. citrus (crinkly leaf psoriasis; Zn and Mn-deficiency).

We report only about the most frequently occurring or important or peculiar virus diseases in Italy.

POMACEOUS FRUITS

1. *Apple and pear:*

a. 'witches' broom' or 'proliferation': occurring in nurseries and less in orchards, in the Veneto, Trentino-Alto Adige and Emilia regions. This is an old Italian disease well known by nurserymen under the name of 'wildness' or 'wild apple'. The infected plants showing visible symptoms are destroyed in nursery, but a number of young symptomless plants are incidentally transported in the field.

This disease occurs in Holland and Switzerland and according to private information, also in Germany.

In the nursery the disease is of slow or quite slow natural spread and spreads very slowly in the orchards. The affected trees are long living, but the crop is without commercial value. In the orchard affected trees are very rare, so that the economic importance of the disease is very small.

Experimentally 'witches' broom' has been transmitted to apple and also to pear.

b. 'flat limb' is of increasing importance on the less cultivated 'Gravenstein', but also on the more frequently cultivated variety 'Abundance', specially in the Emilia region.

c. 'mosaic', wide spread, but apparently not important, chiefly in the Emilia and Veneto regions.

d. 'rubbery wood' (doubtful) in nurseries, in the Toscana region.

DRUPACEOUS FRUITS

1. *Peach:* infected plants are rare and of no economic importance, with the exception of:

a. 'rosetting willow-leaves', frequently occurring, but localized in the Liguria region. The general symptoms resemble those of 'peach rosette' or 'rosette mosaic', but may be better named 'stunt'. The disease has been transmitted experimentally.

The other virus diseases of peach that can be mentioned, but with little or any economic importance are:

b. 'peach wart', very localized and unimportant in the Piemonte and may be also in the Veneto region;

c. 'peach calico' (in Italy reported as 'peach mosaic'); occurring in the Emilia region, but apparently of small economic importance; this disease has been transmitted experimentally.

d. 'ring-spot', 'peach mottle' and 'peach blotch', of which presence is doubtful.

2. *Plum:*

a. only a few plants of Shiro variety, in the Toscana region, show symptoms of 'line pattern', particularly in that form reported in the literature as 'golden net'. Very localized and unimportant.

b. 'white spot', on scattered young trees in the Puglia region. Unimportant.

c. The prune 'leaf spot' of uncertain ethiology has been found in Toscana region.

ORIENTATIVE DISTRIBUTION OF VIRUS, VIRUS-LIKE DISEASES AND NUTRIENT DEFICIENCIES ON FRUIT TREES IN ITALY



A = 'Witches' broom' of Apple
B = 'Crinkle-wood' of Apple
C = 'peach-wart'
D = 'peach-calico'
E = 'ring-spot' of Peach
F = 'peach-rosette'
G = 'peach-mottle'
H = 'peach-blotch'
I = 'rosetting-willow leaves' of Peach
L = 'pinto leaf' of Cherry

M = virus diseases of Almond
N = 'golden-net' of Plum
O = 'mosaic' of Fig
P = 'infective degeneration' of Vine
R = 'die-back' of Apple and Pear
S = 'phloem-necrosis' of Peach
T = 'die-back' of Cherry
U = 'Calico' and 'leaf-spot' of Plum

V = 'phloem-necrosis' of Olive
Z = nutrient deficiencies of Citrus
Y = 'crinkly-leaf psorosis' of Citrus
W = B-deficiency of Apple and Pear
J = 'black-nerved leaves' of Persimmon
K = 'rubbery wood' of Apple

3. *Almond*: the virus diseases of this species have been the object of a special lecture by G. SCARAMUZZI.

Fig: the 'mosaic' is universally occurring in Italy, so that it is almost impossible to find a healthy tree. Probably several virus diseases are confused under this name. The american vector *Aceria fici* has recently been found also in Italy. The economic importance of the disease has not yet been recognized. Transmission experiments have been carried out successfully.

Citrus: 'crinkly leaf psorosis' has been reported from Sicilia, Puglia, Liguria and Veneto regions, but specimens are rare. Up til now this disease has not been transmitted experimentally.

Olive: the complex 'phloem-necrosis' that has been supposed to be a virus disease is in fact due to B-deficiency. But a number of symptoms remain to be explained, as 'witches' broom' and leaf malformations of different kind, probably with the exclusion of 'sickle-leaf' caused by the scale *Pollinia pollini*.

DISCUSSION

MULDER: Why does Prof. CIFERRI think that witches' broom of olive and of apple might be the same? Have there been done any cross transmission between olive and apple?

Answer: This has not been affirmed. Only the common names of the diseases are the same.

MULDER: Between Verona and Bologna there are a lot of Elm trees showing witches' broom symptoms. Has this disease been found to be a virus disease?

Answer: No, this has not yet been in research.

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BETRACHTUNGEN ZUR SYMPTOMATOLOGIE DER OBSTBAULICHEN ABBAUKRANKHEITEN¹⁾

VON

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AUSZUG ZUR VERBREITUNG EINIGER OBSTBAULICHEN VIRUSKRANKHEITEN

1. Im Obstbau sind die *Mosaik-Symptome* als Ringe – auch solche mit Nekrosen (Abb. 1) –, Bänder, Ölflecke, Ölflächen, Streifen u.a. bei uns sehr verbreitet. Ich kenne keine grösseren Kirschen- und Pflaumenanlagen, in denen die eine oder andere Form des Mosaik nicht vorkommt. Im allgemeinen sind sie auf den jeweils befallenen Bäumen nicht sehr häufig. Verhältnismässig selten treten sie auf einer Pflanze gleichmässig verbreitet auf. Auf dem Versuchsfeld der Biologischen Bundesanstalt in Heidelberg steht eine Schöne aus Löwen mit seit Jahren sehr starker Verbänderung (line pattern) auf fast jedem Blatt. Ich kenne einen Hausgarten mit ausgesprochen grossen und zahlreichen Bän-

¹⁾ Der Deutschen Forschungsgemeinschaft sei für die Unterstützung der Untersuchungen auch an dieser Stelle gedankt.



ABB. 1. Viröse Schrotschusskrankheit (Tatter leaf) auf Kirsche
in Baumschule (Eifel)



ABB. 2. Merkmale der Rosettenbüschelkrankheit auf einer Süsskirsche (Streles-Kirsche, Kreis Reutlingen) Blätter (1955) vom gleichen Baum: oben mit, unten ohne Enations

dern und Flecken auf Süsskirsche, Pflaume und Birne, die benachbart stehen. Andererseits zeigt der benachbarte zweite Baum der Schönen aus Löwen auf dem genannten Versuchsfeld der Biologischen Bundesanstalt seit vielen Jahren gleichmässig einen recht schwachen Symptombefall, obwohl beide Bäume auf demselben guten Boden stehen, die gleiche Herkunft und Unterlage (Brompton) haben und gleichzeitig gepflanzt und behandelt worden sind. Bemerkenswert ist auch das seit Jahren verfolgte sehr vereinzelte Auftreten von Mosaik auf sehr alten Kirschen von gutem Wachstum und Ertrag. Selbst bei der sehr stark veränderten Schönen aus Löwen konnte ich im Laufe der Jahre keine äusserlich erkennbaren Nachteile von Fruchtertrag, Fruchtgüte, Frucht reife, Blatt- und Holzreife feststellen.

Ich kenne auch stark verbänderte Freilandbirnen mit sehr vielen verschrumpften Steinfrüchten. Ich habe davon keine Übertragungen machen können. Sollte es sich hier um die Fruchtbeeinflussung durch ein Virus handeln, möchte ich eine Mischinfektion annehmen. Des weiteren sah ich einen Boskoop-Apfel mit so starkem Mosaik-Befall (Aucuba-Mosaik), dass der weissköpfige Baum von weitem auffiel; trotzdem trug er reichlich Früchte, auch an den Trieben mit vielen stark weiss gefleckten Blättern.

2. Die *Rosettenbüschelkrankheit der Kirsche*, die mit der Eckelrader- und Pfeffinger-Krankheit identisch sein dürfte, beschränkt sich bei uns keineswegs auf den südwestdeutschen Raum nördlich der deutschen Schweiz. Sie wurde von mir – z.T. an mehreren Stellen – ermittelt in den Kreisen Ravensburg, Reutlingen, Schondorf, Achern, Heidelberg (Gaiberg, Handschuhsheim), ander Bergstrasse und bei Bonn. Schliesslich traf ich sie in Fagersta, etwa 200 km nordwestlich von Stockholm, auf bereits sehr stark rückgängigen Süsskirschen, deren kleine, schmale Blätter vereinzelte Enations hatten. Enations waren auch auf den nicht wenig verzogenen Blättern der Wurzelschösslinge zu sehen.

Die Krankheit verläuft nach meiner Erfahrung unterschiedlich, zumeist doch verhältnismässig langsam. Die Bäume in Gaiberg sind schon erheblich alt trotz Kurztriebigkeit und gelegentlicher Rosettenbüschel, mangelhafter Düngung und Pflege. Ähnliches gilt von den Kirschen bei Achern, von denen nur kleine Astpartien typisch krank sind. Im gleichen Gebiet wurden bei normalwüchsigen Kirschen auf intakten Blättern Enations gesammelt; sie möchte ich als Virusträger ansprechen. Auch die befallene jüngere Kirsche der Bergstrasse (Seeheim) durfte sich noch jahrelang halten, da hier im Gegensatz zu den jüngeren Bäumen im Kreis Ravensburg das ausgesprochene Rosettenbüschelstadium noch nicht erreicht ist. Das Gleiche gilt von einer Strehleskirsche im Kreis Reutlingen (Abb. 2), die trotz deutlicher Merkmale von Virusbefall (Enations und variable schmale Blätter) dieses Jahr eine Vollernte gebracht hat. Wo die befallenen Bäume bereits Rosettenbüschel in grösserem Umfang zeigen, kann von einem zufriedenstellenden Ertrag nicht mehr die Rede sein. Der Pflanzenschutz sollte Bäume mit Merkmalen der Rosettenbüschelkrankheit besonders im Auge behalten, damit an ihnen für die Praxis wichtige Erfahrungen gesammelt werden.

Das ausgedehnteste westdeutsche Befallsgebiet befindet sich in fast 40 Gemeinden des *Kirschengebietes am Untermain* (in den Kreisen Würzburg, Karlstadt, Aschaffenburg und Alzenau). Es wurde entdeckt durch den planmässigen Einsatz von Sachverständigen durch die Bayerische Landesanstalt für Pflanzenbau und Pflanzenschutz in München. Die wenig gepflegten Süsskirschen stehen

mehr oder weniger verstreut auf Ackerboden. In den von mir besichtigten Lagen von einer Anzahl Gemeinden zeigten viele Kirschen die bekannten Abgangserscheinungen, trockene Äste und Zweige sowie schwache Kronen mit mässiger Laubbildung. Überraschenderweise zeigten die Blätter durchgehend ein gesundes Aussehen: ich sah in keinem Fall ausgesprochene Mosaiksymptome, dafür aber eine bisher noch nie gesehene Menge von Enations auf den zwar kleinen, eng und spitz gezähnelten, im Ganzen aber kaum eingeschnürten Blättern. Ich sah sie auch bei Bäumen ohne jede Spur von Rosettenbüscheln auf Blättern von Edelreis und Unterlage. Zuweilen fehlten trotz Rosettenbüscheln die Enations auf den schmalen Blättern, fanden sich aber auf den Blättern von Wurzelaustrieben und umgekehrt. Verhältnismässig häufig waren sie mühelos auf den Blättern von Edelreis und Unterlage zu sehen. Im Gebiet standen auch inmitten grösserer Bestände vereinzelt kräftige Kirschen mit kolbenartigen Zweigenden, den ausgedehnten Rosettenbüscheln mit Enations auf den schmalen, insgesamt wenig verzogenen Blättern. Diese schweren Krankheitsformen dürfen wohl mit den Kirschen mit Enations ohne sonstige Hauptsymptome in Zusammenhang gebracht werden; anderfalls müsste man fürs Gebiet mehrere Virusträger annehmen, u.a. den von 'rasp leaf virus'.

Die Viruskrankheit herrscht im Gebiet wohl schon seit längerer Zeit; den Besitzern fällt der zurückgegangene Ertrag und der schlechte Zustand der Bäume auf, sie tun aber von sich aus nichts zur Milderung der Plage. Es wird vermutet, dass sie durch 'Inzucht', d.h. durch wahllosen Austausch ein- und derselben Unterlagen und Edelreiser verbreitet wurde. Zweifelsohne ist das Kirschenanbaugebiet verloren, wenn es nicht gelingt, der Krankheit Einhalt zu gebieten. Im Gebiet überwiegt gegenwärtig bei weitem die Anzahl abgängiger Süsskirschenbäume mit abgestorbenen Trieben und Ästen, kleinen Kronen ohne Rosettenbüscheln, aber mit Blattenations gegenüber der Anzahl Kirschen mit Rosettenbüscheln und Enations, d.h. Ertragsminderung und Baumausfall durch schlechte Pflege liegen noch höher als die durch Viruskrankheit.

In einer bestens gepflegten Anlage in *Oberbayern* (Kreis Ingolstadt) sind eine Reihe wüchsiger Kirschbäume von der Rosettenbüschelkrankheit befallen. Die vor zwei Jahren auf die erkrankten Bäume (Fromms Schwarze Herzkirsche) aufgesetzten Reiser von Hedelfingen, Schmalfelds Schwarze u.a. Sorten zeigten heuer die typischen Rosettenbüschel ohne jede Spur von Enations. Die gleichen Erscheinungen hatten bei einigen Bäumen auch die Unterlage, die Fromms Schwarze Herzkirsche. Die Bäume ohne Rosetten zeigten sehr häufig Mosaik und sehr variable langgezogene und missgestaltete Blätter; offenbar Übergangserscheinungen, die mir von anderen Orten geläufig bzw. bekannt sind.

3. Wenn ich an die vielen 'triebsüchtigen' (blastomanischen) Apfelbäume denke, bin ich wegen der dieser Krankheit nachgesagten Bedeutung sehr beklommen. Ich hoffe auch hier auf eine Milderung der Folgen nach Befallsgrad und unterschiedlicher Widerstandsfähigkeit der Sorten. Auf dem Versuchsfeld der Biologischen Bundesanstalt in Heidelberg, das im Frühjahr 1942 bepflanzt wurde, waren im Herbst 1951 von jeweils 21 Büschen, zumeist auf Unterlage II, besensüchtig (einschliessl. Vergrösserung der Stipulae) Landsberger Renette und Berlepsch (je 62%), Boskoop (52%), Laxtons Superb und Goldparmäne (je 29%, letztere Sorte 2 mal 21 Büsche), Signe Tillisch und Blenheim Goldrenette (je 24%), Allington Pepping und Schöner aus Nordhausen (je 14%), Cox Orange und Weissler Klar (je 5%). Seinerzeit frei waren Ontario, Oldenburg, Jakob Lebel,

Champagner Renette. Von den Sorten, von denen jeweils 4 Büsche vorhanden waren, zeigten die Krankheitssymptome Blenheim Goldrenette (3), Gaskogner Scharlachroter, Ananas Renette, Kaiser Wilhelm, Riesenboiken, Biesterfelder Renette, Gravensteiner und James Grieve (je 1).

Über die jetzige Lage im Quartier besitze ich keine zahlenmässigen Auswertungen; nach dem allgemeinen Zustand der Bäume zu urteilen, dürfte die Krankheit zugenommen haben. Von der Sorte Johannes Böttner, die 1951 frei von Austrieben war, hat ein näher beschener Baum zahlreiche Schosse mit typischen Absterbeerscheinungen. Er zeigt die grössten bisher gesehenen Nebenblättchen und ausserdem ein bei dieser Sorte seit längerem beobachtetes buschiges Wachstum der Krone. Die zahlreichen kleinen Früchte bleiben unansehnlich. Da auch die jungen Apfelbäume in der unmittelbaren Umgebung des Versuchsfeldes (Hochstämme) Triebsuchtsmerkmale zeigen (besenartige Austriebe und deutlich vergrösserte Stipulae), ist die zunehmende Ausbreitung der Krankheit im Gebiet wahrscheinlich. Die Symptome sind auch im 'Gebirge' von Heidelberg, den Westhängen der Bergstrasse, häufig; ich kenne sie dort seit etwa 1950 sehr stark bei der angeblich aus den USA stammenden Loti, einer Verwandten des Klarapfels. Der Besitzer glaubt die Triebsucht durch ständigen Schnitt gedämmt zu haben; sie ist bei den haupterkrankten Büschen noch vorhanden. Neben grossen Nebenblättern zeichnen sich ihre Kronen durch reiche Verzweigung und durch eine auffällige Biegsamkeit der Zweige aus; sie können ohne Bruch kreisförmig gebogen werden.

Bei diesen Feststellungen, die sicher leicht vermehrt werden können, ist die ernste Frage nach der Bedeutung der Krankheit für die Praxis dringend zu klären notwendig. Lassen sich die stärker heimgesuchten Bäume durch den Schnitt tatsächlich korrigieren und für längere Zeit im Ertrag erhalten? Vordringlich erscheinen mir hier Auslese- und Kreuzungsversuche mit als wenig empfindlich erkannten Formen.

DISCUSSION

PANJAN: Is there any difference between the damage caused by the cicadellid *Ceresa bubalus* and the deformation of the twigs shown by Dr THIEM?

Answer: It is difficult to make an exact difference.

STANCOVIC: What may be the cause of the strong ramification of walnut leaves?

Answer: It is not possible to judge without having seen the trees.

A NEW METHOD SUGGESTED FOR BREEDING FRUIT TREES RESISTANT TO VIRUS DISEASES

BY

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Contemporary science has not yet given reliable means of curing virus diseases, which seriously menace some fruit species, especially the stone and citrus fruit trees. And when it is a question of plant viruses which have vectors, the usual preventive measures are very difficult to carry out. That is the reason why the growing of fruit trees which are resistant to the virus diseases is very important.

However, the breeding in this direction does not give satisfactory and reliable results. The main reasons are: 1) it is difficult to find the fruit varieties, which are both entirely resistant to viruses and have good quality fruits; 2) there is no certainty in combining, through hybridization, the resistance of one parent and the quality of fruits of another parent; 3) there is no certainty in obtaining the variety which will remain resistant long enough or even tolerant, as shown by the example of the virus tolerant strawberry varieties (DARROW, GOHEEN et al (12)).

Let us pay attention to the Yugoslav prunes menaced by the virus disease Sarka (JOSIFOVIC (27)). In spite of some opinions about the existence of varieties resistant to that virus (HRISTOV (24), POBEGAJLO (42)), the Sarka is apparently manifested on many plum and prune varieties grown in Yugoslavia, and even on the nearly wild plum tree *Prunus myrobolana* (STANCEVIC and PAVICEVIC (48), STANKOVIC, PAVICEVIC and BEBIC (47)). Could we speak at all about the prune varieties really resistant to the Sarka disease? If we cannot find these varieties, then it is not advisable even to try breeding in this direction.

Nevertheless, it is very necessary to make efforts in breeding, in order to obtain the fruit varieties which are completely or practically resistant to virus diseases. But, for a successful work we are obliged to search for better methods, to improve the usual varieties and to find out new ones.

In the author's opinion, it is necessary first of all, to develop and apply precisely the method for effecting the influence of nucleic acids, in order to form the resistance of fruit trees to the virus diseases, using the extremely important role of these substances for the manifestation and transmission of the inherited characteristics of all live beings (BRACHET (9 and 10), KHOUVINE, MORTREUIL et al (29), PEREY, MANDEL et al (41), RATH (43), BERNSTEIN (6), ROWLANDS (44), MARSAK and MARSHAK (36), LANCE (31), KHOUVINE and WEISMANN (30), MULLER (38), CAMEFORT (13), SCHWABITZ (45), BACQ and ALEXANDER (4), BUTENANT (11), KANAZIR (28)). Although there has been no sure proof so far as to the influence of the nucleic acids upon the formation of resistance of fruit trees to virus diseases, this possibility cannot be excluded. We have some facts showing these possibilities: 1) with micro-organisms one can safely obtain adequate changes of inherited nature, and the corresponding changes of the morphological and physiological characteristics, under the in-

fluence of appropriate nucleic acids added to the nutritional media, in which the above mentioned micro-organisms have been grown (GRIFFITH (20 and 21), AVERY, MACLEON et al (3), BOIVIN, DELANNOY et al (7), BOIVIN (8), TAYLOR (50), ALEXANDER and LEIDY (1), ALEXANDER (2), HOTCHKISS (22 and 23), ZAMENHOF (54), SCHWANITZ (45), KANAZIR (28)); 2) in F_1 and F_2 generation of tomato grafted on eggplant has been noticed a more vigorous growth, and in leaves and young branches considerably more nucleic acid was found than in the corresponding organs of the new grafted rootstock and scions of plants (SEMENENKO and TIMASOVA (46)); 3) by growing young embryo culture of lemon in appropriate solution to which has been added an extract of cotyledons of some other citrus, and then followed by grafting the obtained shoot on a suitable rootstock, a favourable inherited change may be obtained on the seedling (ZDRUJOVSKAJA (57)); by appropriate rootstock and grafting, especially under the extreme ecological conditions of the USSR, various inheritable changes have been effected, which may be explained by the changed conditions of the formation and the metabolism of nucleic acids, as well as by other similar influences of biochemical nature, through these substances (BAZAVLUK (5), GORSKOVA (19), CERNENKO (13), ISAEV (25 and 26), MICURIN (39), MARKOV (35), TURBIN and HABAROVA (53), GLAVINIC (18), ZORIN (58 and 59), TAVCAR (49), MAMONTOVA (34), TERNOVSKI (51), MEDINEC (37), MACLAREN and MICHIE (33)).

Judging by the results obtained up to now, the author considers that it would be expedient to improve the method of ZDRUJOVSKAJA (56) applying the nucleic acids to the selected fruit tree varieties, in order to influence the sexual cells, both male and female, before their fusion during the fecondation, then on young embryo, and finally on the young fruit tree. To make it more clear, the author suggests the following procedure:

To inject the extracted nucleic acids from cotyledons of specially selected fruit trees just before the meiosis of sexual cells and by this means affecting the embryo sac and pollen cells during their formation. Instead of the injection one can try to wet the flower buds in order to get the same effect. In the same way it is necessary to affect the first phases of embryo development. Then as early as possible one must isolate the embryo to be developed and to germinate in artificial media which is quite possible (TUKEY (52), GILMORE (17), NICKELL (40), DANIELSSON (14), ZDRUJOVSKAJA (55, 56 and 57), LOUIS and SHOPFER (32)). For this artificial culture of the isolated embryo one must apply not just the ordinary extract of cotyledons but the extract of nucleic acids from the cotyledons. Finally, the quite young seedling must be, as soon as possible, grafted on developed trees, which is safely possible (ZDRUJOVSKAJA (56), LOUIS and SCHOPFER (32), EVANS and DENWARD (16)). It is quite obvious that in this succession it is necessary to use the same influence, i.e. the nucleic of the same previously selected fruit trees, the influence of which we have to use in order to obtain, in this case, the resistance to virus diseases. It would be very important and useful to combine those methods by the application of different radiation/x-rays, gamma rays from CO_{60} and so on.

The author supposes that those methods will give us the possibility to influence the biochemical processes of cells, responsible for the inheritable changes.

That is the reason why the author thinks that it is very necessary, for a

successful work, to combine the efforts of the specialists in fruit breeding, phytopathology and biochemistry.

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DISCUSSION

THUNG: In what way do they consider nucleic acids and what kind of nucleic acids are meant? Will they be taken up by the embryo?

Answer: The nucleic acids are the main factors of heredity. All the nucleic acid is extracted. This is very difficult. The different nucleic acids can not be separated so all nucleic acids are extracted. Sometimes the embryo will assimilate these, or select some of them.

BAUMANN: Was the sap of the frost resistant Crassulacae sprayed over the seedlings or injected in them?

Answer: The extracted sap was used in two ways: by spraying the leaves of cabbage and by adding it to the media for germination of cabbage seeds.

THUNG: From the data mentioned it is not sure that there is any basis for the suggestion that nucleic acids can be applied to and will influence virus diseased plants.

Answer: We are not sure too but it can be tried. According to the mentioned results realised up to now, we can expect some very important success in this direction.

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FIELD INSPECTION ON VIRUS DISEASES IN ARBORICULTURE IN THE NETHERLANDS

BY

P. H. VAN DE POL

Plant Protection Service, Wageningen, Netherlands

For a considerable time the importance of a direct application of the results of scientific research in practice is recognized in the Netherlands. That is why a close cooperation exists between the Institute for Phytopathological Research, the Plant Protection Service and the Field Inspection Boards; also between research, practical application and regulation and the performance of the inspection. I should like to tell you something about this, because this cooperation forms the base of the work done in practice.

First a few words about the actual field inspection. As more and more countries require field inspection as regards the state of health, we see this work as a necessary and important part of the whole export inspection. Field inspection is carried out by the General Inspection Board for Arboriculture of which Mr ERKELENS is the director.

The General Inspection Board for Arboriculture (N.A.K.-B.) endeavours

to ensure that only pure and healthy material will be placed at the disposal of fruitgrowers both at home and abroad. For the achievement of this object it is essential that all firms engaged in the cultivation of N.A.K.-B. plants should become affiliated to the Inspection Board. If some nurseries fail to come within the sphere of the N.A.K.-B. the danger arises that inferior nursery material comes on the market. Hence the government stated in a Affiliation decree for arboricultural products, that anyone growing arboricultural products within the scope of the N.A.K.-B. must become affiliated to the Inspection Board. In addition to this the N.A.K.-B. has stipulated several conditions with which nurserymen and firms have to comply in order to qualify for admission.

There exists in the Netherlands

a compulsory affiliation to this Inspection Board.

furthermore there are certain requirements for admission.

This means that all N.A.K.-B. plants are under inspection in the field and that there are certain minimum standards concerning conditions in the nursery.

There are three types of field inspection. In the first place the inspection of the parent trees. The Board has prescribed that only approved trees or bushes shall supply the vegetative material of different varieties of apples, cherries, peaches, pears and plums. Especially the varieties which can carry certain virus diseases or those which are easily mixed up with other varieties are admitted to this parent tree inspection. Each approved parent tree is permanently certified by means of a small metal plate, indicating a number and the name of the variety. The parent trees are reinspected yearly to see whether they are still up to standard. The material supplied to nurserymen from these approved trees is certified by the N.A.K.-B. inspectors in the same way as young trees and rootstocks.

In the second place there is the field inspection of rootstocks and grafted material. This inspection is carried out by the inspectors once, twice or more times every year, according to regulations, compiled in bookform and issued to the affiliated growers. Material which does not come up to standard upon the field inspection should in general be destroyed. I will come back to the concerning regulations.

Finally we reach the bulk inspection and certification. The so-called bulk inspection generally takes place shortly before the material is dug and sold. Now all material must be free from abnormal or diseased plants. The certification is carried out during the bulk inspection by attaching to each approved tree a certification strip, bearing the mark of the N.A.K.-B. and indicating the rootstock, variety and possibly also the quality.

It is important that all N.A.K.-B. plants are certified before marketing or export.

Another important point is that as regards N.A.K.-B. plants the Plant Protection Service gives a certificate of health only after approval of the plants in the field by the N.A.K.-B.

Thus we base our final inspection also on the field inspection of the N.A.K.-B. In this connection there is a close cooperation between N.A.K.-B. and P.P.S. Some of our officers are district adviser or general adviser to the N.A.K.-B., while Dr BRIJËR in his function of Director of the Plant Protection Service superintends the whole N.A.K.-B. inspection as far as plant diseases and pests are concerned.

In the inspection regulations virus diseases are classed in the category of the serious diseases and pests. The following general stipulations have been inserted with respect hereto.

In the first place parent trees must be free from these diseases.

The grower is obliged to remove and destroy continuously young material and rootstocks which are infected by serious diseases and pests. If a considerable number of diseased plants is removed after which it is feared that the remaining crop is not sufficiently healthy, the material can be kept under inspection during one more year.

In case of rejection on account of serious diseases and pests the grower concerned must destroy or have the material destroyed under supervision of the N.A.K.-B.

All plants affected by diseases and pests indicated as serious in the inspection regulations, must be removed by the time of the final inspection in the field.

The Plant Protection Service has intensive contact with N.A.K.-B. concerning field inspection. In difficult cases N.A.K.-B. and P.P.S. take a combined decision. In all cases activities are based on diagnostic or scientific work carried out by the Institute for Phytopathological Research. Cooperation between these three institutes, has formed a constructive body which enables the application of recent scientific information directly in practice, very much to the advantage of the Dutch arboriculture.

DISCUSSION

ATKINSON: Can the tags be removed and attached to other trees?

Answer: No. The tags are attached to the trees with a special instrument.

POSNETTE: How can it be seen that the growers only use budmaterial from certified parent trees?

Answer: A certain amount of the budmaterial is certified and afterwards the inspector can see if there are more or less grafted plants than there should be.

POSNETTE: Does the nurseryman collect his own budwood from his own trees?

Answer: No. The deliverance of budwood of the varieties mentioned in the regulations can only happen via the N.A.K.-B.

POSNETTE: Has each grower his own parent trees?

Answer: No. There are special parent trees in only relatively few nurseries. The growers have to apply to the N.A.K.-B. to obtain the varieties wanted.

HARRIS: Is the inspection only carried out on visual symptoms?

Answer: Up to now the inspection on visual symptoms is the most important one, but as a matter of fact this method is not sufficient. Therefore we start a new scheme this year. In future the material (parent trees and rootstocks, will be tested for virus diseases with special indexing methods.

ATKINSON: How is it guaranteed that the growers obtain all the quantity of budwood they want in case the parent tree of that special variety dies?

Answer: In Holland we have quite a lot of parent trees of each variety. For instance there are about 800 parent trees of different peach varieties.

ATKINSON: How many scions are delivered each year?

Answer: This year about 400.000 scions have been delivered.

MORVAN: Is there a special number for each proved parent tree?

Answer: Yes.

MORVAN: Is the number of the parent tree quoted on the label of each young tree?

Answer: No. Only the varietal name is mentioned.

MORVAN: Is there any real objection to put the number of the parent tree on the labels of the young trees, so that one can see which parent tree is infected, when young trees show virus symptoms?

Answer: This is a good suggestion but practically it will be too complicated. Then at least each group of scions must be kept apart and growers then will have to do a lot of administration work. Of course this depends largely on the quantity of budwood that is wanted.

POSNETTE: Sometimes we find in England Dutch material without labels. Can growers remove them?

Answer: Some foreign nurserymen do not want the material labelled. It is not known why. After the Plant Protection Service inspected the plants for export it is possible to remove the labels in certain cases.

ATKINSON: When a grower has to destroy infected trees will he receive any compensation for it?

Answer: No. When he grows infected trees it is for his own risk. This is described in the regulations.

RONDE KRISTENSEN: Does a nurseryman have to pay for the destroying of trees?

Answer: Only if the NAK-B or the Plant Protection Service must do it (in case the grower refuses to collaborate) he will have to pay.

ATKINSON: Is all the exportmaterial of Dutch origin or do the Netherlands also import seedlings?

Answer: Some seedlings are imported, for instance plum seedlings from France.

ATKINSON: Is there any control on the condition of these trees?

Answer: You can check it the next year, when they come into the field inspection. Then the infected plants must be removed.

FITZPATRICK: Can any material be sold in the Netherlands without being labelled?

Answer: No. All material must be certified.

AN INDEXING SCHEME IN THE NETHERLANDS

BY

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Field inspection of nurseries with respect to virus diseases of fruit trees as described by VAN DE POL (1) needs a supplement to reach the purpose of supplying the *fruitgrower* with material which is virusfree as far as possible.

The way in which field inspection of nurseries with respect to virus diseases in the Netherlands is carried out nowadays only consists of selection on visual symptoms. Material that shows symptoms of known virus diseases is destroyed. Hence destroying is part of the inspection work. It would be an advantage if this could be avoided.

In our opinion this can be reached to a high degree by supplying the *nurserymen* with material guaranteed to be free of known viruses as far as possible. This can be reached only to a certain extent by regular visual inspection of the source material, i.e. the scion mother trees and the nursery beds of the vegetatively propagated rootstocks. However this method is insufficient because of the following reasons:

- a. the possibility of symptomless carriers;
- b. the possibility of overlooking faint symptoms which only occur in a few leaves;
- c. the possibility of prevention of symptom expression by climatic or other conditions influencing growth in a certain year;
- d. some virus diseases only show symptoms on the fruit skin, which can be observed in the case of scion mother trees but which can not be observed in the case of vegetatively propagated rootstocks.

Thus work supplementary to the field inspection of nurseries and of source-material has to be done in order to get material both of scions and rootstocks guaranteed to be free of known viruses. Up till now this supplementary work can only be done by indexing.

Field inspection of nurseries in the Netherlands already assures the *fruit-growers* of practically virusfree plants. Indexing will provide the *nurseries* with guaranteed virusfree source-material on the shortest term possible.

To this purpose a scheme was made for testing the mother trees of the leading fruit varieties grown in Holland.

With regard to vegetatively propagated rootstocks one can say that here in the first place international cooperation is possible and necessary. There is no sense in producing at the same time several tested clones of one type in different countries. We will await the development of international cooperation in this respect before we start work on it.

In our opinion mother trees of the fruit varieties have to be tested first of all by each country individually because of the differences between the lists of varieties. Evidently also in this respect international exchange of tested material is very desirable.

The scheme has been prepared during the past year and will be carried out by the Plant Protection Service. It is based on the experiences of a preliminary experiment on rubbery wood and on work done in England at East Malling Research Station by POSNETTE *et al.* (2). The scheme was designed by the Plant Protection Service in close cooperation with:

- a. the Institute of Phytopathological Research (I.P.O.), which in future also will carry out the basic scientific research and will develop the test methods for the different virus diseases,
- b. the Institute of Horticultural Plant Breeding (I.V.T.) which will also supply information on special nursery techniques and
- c. the Netherlands General Inspection Board for Arboriculture (NAK-B) which in future will take care of large scale propagation of the guaranteed virusfree material and will deliver it to the nurseries.

The preliminary experiment was carried out in 1953 and 1954 by the I.V.T., the I.P.O. and the Plant Protection Service and showed that out of six NAK-B mother trees of Golden Delicious none was free of the rubbery wood virus and out of six NAK-B mother trees of Lord Lambourne four were free of this virus. Some of the tested M IX rootstocks were also infected.

The main fruit crops in Holland are apple, pear, cherry and plum. The scheme will start in 1956 with the apple, the main crop of these four. About four thousand mother trees of the NAK-B belonging to 27 varieties and spread over the country will be indexed. Four scions of each mother tree will be taken in four different places of the crown of the tree. Two of them will be indexed with one indicator, two with another. They will be indexed for the occurrence of the virus diseases of the apple known in Holland: rubbery wood, rough skin of the fruits, apple mosaic, proliferation and rosette. As it is necessary to await the formation of fruits for the observation of rough skin, it will be possible to observe at the same time the possible occurrence of chat fruit, which has not been known in the Netherlands up till now.

At first one-year-old seedlings will be used as rootstocks, as this is the only material now available which is guaranteed virusfree. As soon as possible we will change over to indexed M VII, which has the advantage of more uniform and weak growth.

The indexing method was described earlier by POSNETTE and CROPLEY (2). The indicator is grafted onto a scion of the mothertree and this combination is grafted upon a seedling. Two thousand five hundred mother trees will thus be indexed in this way in January and February 1956, another 1500 by double-budding in the summer of 1956. For the latter purpose two buds are put on each seedling, the top one from the indicator and the bottom one from the mother tree under test. Only the top one is allowed to grow, the other will be destroyed soon after.

There are two types of control plants. The positive control plants consist of grafts of a healthy indicator on a diseased indicator on a seedling. They are made to observe whether the virus concerned is transmitted and how the symptoms are expressed in that particular year. Positive control plants will be made for each virus disease concerned, one control tree per 40 trees. The negative control plants consist of an indicator scion immediately grafted upon a seedling.

They give the possibility to observe whether the indicator and the rootstock used were indeed virusfree.

The indicator varieties to be used are Goudreinette (Belle de Boskoop) and Lord Lambourne. With the first indexing will be possible for rough skin, proliferation, rosette and mosaic, with the second for rubbery wood, mosaic and for chat fruit, when necessary.

The first results may be awaited within two to six years: in two years for the diseases, which give symptoms in the leaves or wood, in at least six years for the diseases, which give symptoms on the fruits.

At first all the indexed mother trees which show to be free of the diseases observed will form the source for the nurseries. It is the intention to concentrate later on in a special field only a few of such trees, which will be indexed more thoroughly. Re-indexing will take place as often as may be necessary.

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REPORT ON THE DISCUSSION ON INTERNATIONAL EUROPEAN COOPERATION IN FRUIT TREE VIRUS RESEARCH

On Saturday morning August 27, 1955, a general discussion was held on international European cooperation in tree-fruit virus research under the chairmanship of Dr R. V. HARRIS, head of the Plant Pathology Department of East Malling Research Station (G.Br.). As aims of such a cooperation were proposed:

1. To accelerate the acquisition of knowledge by pooling experience of the diseases under differing conditions.
2. To avoid the time-lags caused by delays in publication of research results, thus accelerating their application in practice.
3. To avoid the wide dispersal of viruses in infected plant material by collectively working towards the production and use of virusfree clones.
4. To avoid synonymy and confusion in the literature by
 - a. using agreed common indicator varieties and species.
 - b. exchange of visits, and agreement on nomenclature, prior to publication if possible.

Some proposals were made by Prof. R. CIFERRI and Dr G. SCARAMUZZI:

1. Establishment of a European Committee of nomenclature for fruit tree virus diseases, working in agreement with American research workers, with the purpose of the uniformity of the nomenclature.
2. The sub-Committee will also be charged with the centralization of dry and preserved specimens, coloured photographs and descriptions, for free consultation and reference.

The following conclusions could be drawn from the general discussion:

1. The international cooperation in tree-fruit virus research especially in Europe can be furthered along the following lines:
 1. Personal contact between individual research workers in different countries.
 2. The organization of symposia.
 3. The use of the same indicator plants in the different countries to aid the identification of the virus diseases concerned.
 4. The publication of a handbook on European fruit-tree virus diseases.
2. A European Committee for Cooperation in Fruit Tree Virus Research has been established with the aim of promoting the points 1.2, 1.3 and 1.4 (see above). The first tasks of this Committee are:
 1. Making preparations for the next symposium.
 2. Composing a list of recommended indicator varieties and species for fruit tree viruses in Europe, which will be the first step towards uniformity of nomenclature, and to be presented before the next symposium.
 3. Composing a European bibliography with the help of one correspondent per country as a first step towards the composition of a handbook and to be presented at the next symposium.
3. As members of the European Committee were asked to act:
Dr S. BLUMER (Wädenswil, Switzerland)
Ir C. A. R. MEYNEKE (Wageningen, Netherlands)
Dr D. MULDER (Wageningen, Netherlands)
Dr A. F. POSNETTE (East Mallng, Great Britain).

Dr BLUMER did not accept the nomination and afterwards advised to ask Dr R. BOVEY from Lausanne (Switzerland). The others accepted the nomination. (Dr BOVEY also accepted the nomination in the meantime).

4. In general the following reasons were put forward for holding a symposium in a certain country and a measure of support was expressed for each:
 1. actual research has been done, f.i. on transmission of virus diseases, selection of virusfree material, etc.;
 2. interesting symptoms of diseases resembling virus diseases already known in other countries have been found.

This implies that such symposia will not necessarily be held yearly but only periodically when wanted and needed.

5. It has not been made a principle to restrict the symposia to pome and stone fruit species, but it has been considered practical to confine the symposia to woody fruit plants grown in Europe with the exception of vines. Main criterium has to be the fact whether research is done on the subject or not (see also point 4.1).
6. The next symposium will be held in 1956 in East Mallng (G.B.), for which symposium Dr A. F. POSNETTE will act as secretary. One of the tasks of this symposium will be to agree on the use of the proposed standard list of indicators and to stipulate further steps towards the composition of the handbook.

7. It was not thought practicable – in view also of the experiences in the U.S.A. and Canada as brought forward by Dr BERKELY (Can.) – to try to establish a bureau or a permanent central point for collecting documentation on virus diseases of fruit trees in Europe (photographs, herbarium-material, lanternslides, etc.). This would cost too much time for too small an effect.
8. The European Committee for Cooperation in Fruit Tree Virus Research will keep in contact with research workers outside Europe. This contact can be established by keeping some correspondents overseas informed on the activities in Europe as was asked for by Dr ATKINSON (N.Z.). It will be of importance to establish contacts with the North American working-parties in this field. Especially it will be of importance to agree upon the same minimum host range in U.S.A. and Europe. Exchange of indicator material will be highly desirable.
9. It was decided to inform F.A.O. and E.P.P.O. that a symposium on virus diseases of fruit trees in Europe was held in the Netherlands in 1955 and that a permanent organization has been made, acting by means of a European Committee for Cooperation in Fruit Tree Virus Research.
10. Prof. T. H. THUNG, member of the symposium and chairman of the Committee on the Classification and Nomenclature of Plant Viruses of the International Botanical Congress, was asked to give the same information to the International Botanical Congress.

Wageningen, Netherlands
November 1955

C. A. R. MEYNEKE
D. MULDER

A STANDARD MINIMUM RANGE OF INDICATOR VARIETIES FOR FRUIT TREE VIRUSES IN EUROPE

Composed by the European Committee for Cooperation in Fruit Tree Virus Research.

Note: This list of suggested indicators will need to be amended periodically as new information becomes available. Alternative indicators are given in brackets.

Host	Disease	Virus indicator	Where obtainable
Apple	Rubbery wood	Lord Lambourne	East Malling
	Mosaic	" "	" "
	Chat fruit	" "	" "
	Proliferation	Belle de Boskoop	Holland
	Witches' broom		
	Rough skin	Belle de Boskoop	"
	Star crack	(Glorie van Holland)	"
	Flat limb	Gravenstein	Denmark
	Rosette	Belle de Boskoop	Holland

Host	Disease	Virus indicator	Where obtainable
Pear	Stony pit	Beurré Hardy (Clapp's Favourite)	East Malling
	Mosaic	Beurré Hardy (Brederode)	" " Holland
Cherry	Ring spot (including tatter leaf and ring mottle)	Mazzard F 12/1	East Malling
	Rugose mosaic (rosette)	" "	" "
	Rusty mottle	" "	" "
	Leaf roll	" "	" "
	Yellow mosaic (caused by plum line pattern virus)	" "	" "
	Rasp leaf	Bing (Napoleon)	" "
	Pfeffinger		
	Eckelrader		
Plum	Sour cherry yellows	Montmorency	" "
	Prune dwarf	Italian Prune (Lombard Plum)	East Malling
	Line pattern	Myrobalan seedlings (Mazzard F 12/1) (Shiro plum)	" " Locally East Malling
		Mazzard F 12/1 (Myrobalan seedlings)	" " East Malling Locally
		(Peach seedlings)	" "
Peach	Bark split	Cambridge Gage	East Malling
	Plum pox	Pozegaca	Jugoslavia
	Ring spot	See plum and cherry	
	Line pattern		
<i>Latent stone fruit viruses</i>	Other diseases	Peach seedlings	Locally
	Ring spot strains	Peach seedlings	Locally
		Shirofugen	East Malling
		Kwanzan	" "
	Dusty yellows	F 12/1	" "
	Dark green mottle	Peach seedlings	Locally

East Malling, 29-9-55

The Committee:
h.t.

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